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Number 6

Mariners Weather Log

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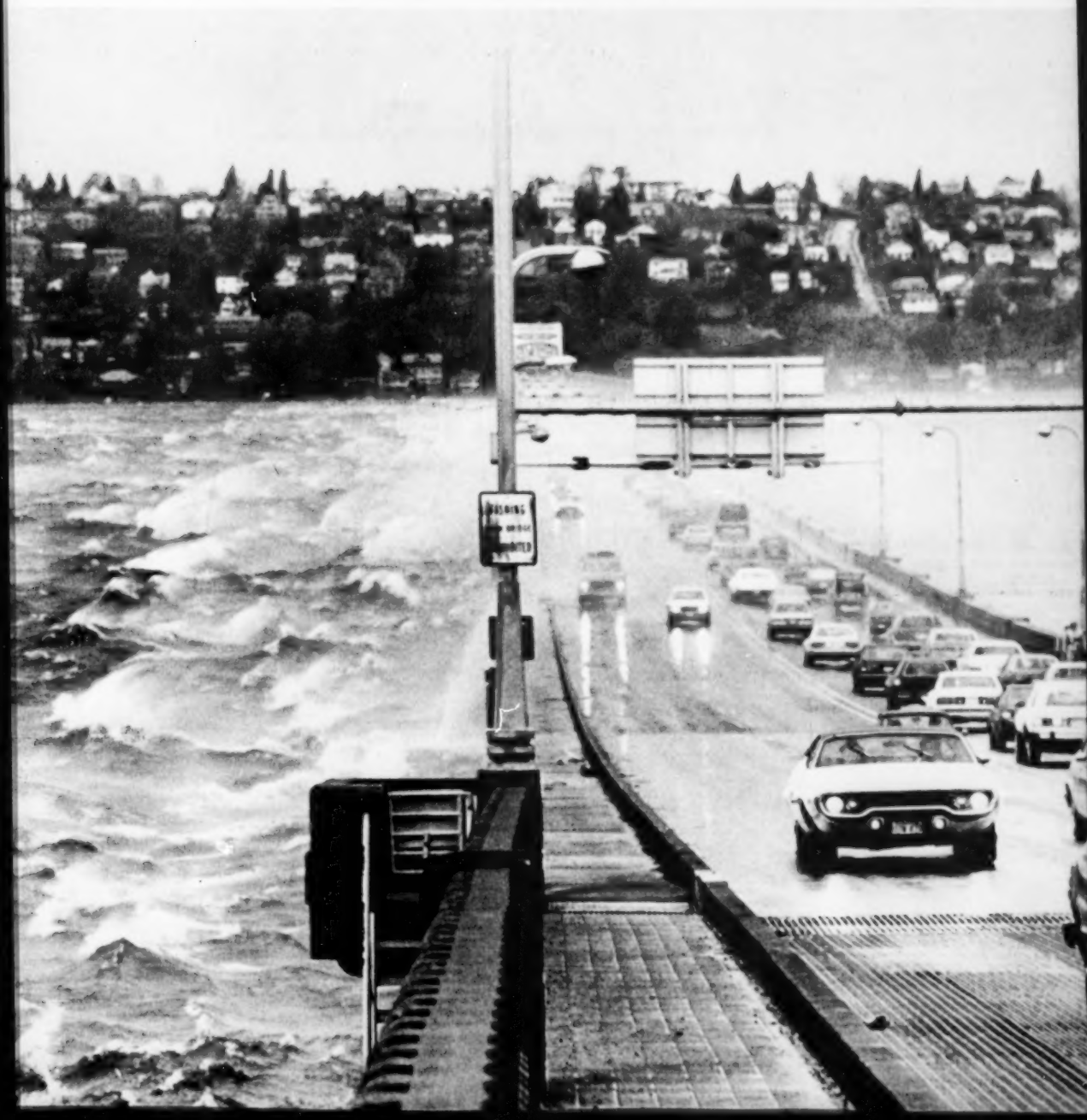

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Mariners Weather Log

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Washington, D.C.

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Front Cover: Gale-force winds cause white caps on Lake Washington between Seattle and Mercer Island. The water is relatively smooth north of the floating bridge. A 964-mb storm centered just off the coast moved ashore over Vancouver Island. Wide World Photo.

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The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1983.

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Mariners Weather Log

BORE TIDES IN UPPER COOK INLET

Von S. Woods
Federal Aviation Administration
Atlanta Center
Hampton, Ga.

A unique phenomenon seen by Anchorage, Alaska, residents is the tidal bore (fig. 1), often referred to as a bore tide or bore. A bore tide can be defined as a high, breaking wave of water advancing rapidly up an estuary (U.S. Navy, 1966). The bore is similar to a wave that has crested but not broken and stays crested as it moves forward. It thus represents a stationary wave that is being translated forward. Bores can occur in the mouth of a river or in inlets as they do in Turnagain and Knik Arms of upper Cook Inlet, Alaska (fig. 2).

Among the better-known bores in the world are the ones at the mouth of the Amazon River, called the Pororoca, which can reach a height of 25 ft (Van Dorn, 1974), and at the mouth of the Chien Tang Kiang River near Hangchow, China, which reach a height of 10 to 20 ft and a speed of 18 to 24 mi/h.

Bores occur in many varied places and under differing conditions around the world; however, they do have some common elements.

Bores, in general, form when the incoming tide is concentrated by a shallowing bottom at the mouth of

Figure 1.--A photograph of a bore tide in Turnagain Arm taken by Von Woods. He estimated the height as 2 to 3 ft with a speed of 5 to 6 mi/h.

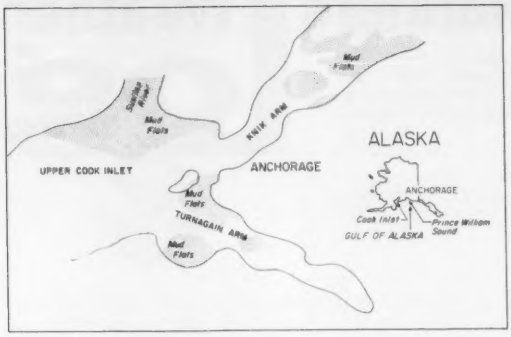

Figure 2.--Map showing Turnagain Arm, Knik Arm, and Anchorage plus some of the bottom topography of Upper Cook Inlet.

an estuary and/or a narrowing estuary. They can occur at any time but are usually most dramatic at spring tides. Also, a strong tidal difference or gradient is needed.

The bathymetry or bottom topography of Turnagain and Knik Arms is similar. At low water, both are largely exposed mud flats interspersed with channels of slightly deeper water.

The bathymetry of Turnagain Arm appears to be more conducive than Knik Arm to the production of bores because: (1) its bottom shallows so that most of it is mud flats at low water near its mouth, and (2) the estuary narrows as it extends inland.

Knik Arm appears less suitable for the production of bores, but they do occur. The primary restriction is the bottleneck just north of Anchorage.

An earthquake which occurred in 1964 caused changes to the bathymetry of both arms as evidenced by the lowered land, sunken trees, and settled buildings. The height of the bores now would be less than before the earthquake, because the water at low tide would be deeper. There are areas in the world where bores use to occur, but because of dredging operations they no longer occur or are much reduced (Smith, 1969).

There is a relationship between the height of the surface of moving water and the rate at which the bottom shallows and the speed of the moving water or current. The relationship is as follows: the speed of the bore varies directly as the square root of the water depth (h) before the bore arrives. Figure 3 illustrates that as the bottom starts to shallow, the surface of the water falls and the speed of the current increases since the same volume of water must pass a given point in a given time. As the bottom continues to rise, the current speed increases to equal the critical value of $\sqrt{gh}$ (where g is the gravitational constant).

At this point an unstable condition exists. Any further increase in speed or shallowing of the bottom will cause the water level to rise rapidly or crest, and the bore would be formed.

Let us now look at a mathematical model of the bore. From it we can see better how the bore forms and help explain some of the effects observed with the bore.

Consider the case of an incoming tide approaching a shallowing bottom as shown in figure 4. The change

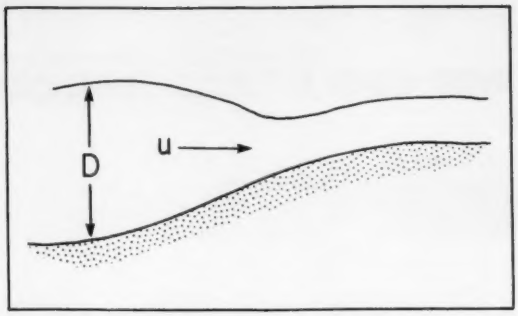

Figure 3.--Illustration of the effect on an incoming tide of a shallowing bottom.

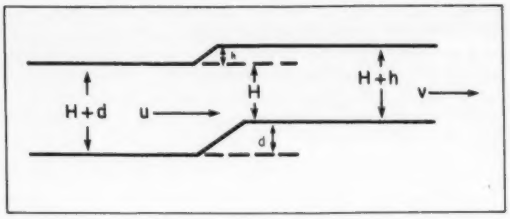

Figure 4.--Schematic of the effect of a sloping bottom on water moving up the slope.

in energy of a particle on the surface of the incoming tide is:

$$1.\quad \frac{u^2}{2} - \frac{v^2}{2} = gh$$

u = speed of incoming tide;
v = speed of tide after passing over an incline of height d;
g = gravitational constant;
h = height the surface of the incoming tide rises after passing over incline d.

The equation of continuity for the same case gives:

$$2.\quad (H + d)\,u = (H + h)\,v$$

H = height of water between the floor of the estuary and the surface of the incoming tide.

Equations 1 and 2 can be solved (Tricker, 1964) to give:

$$3.\quad h = \frac{d}{1 - \frac{gH}{u^2}}$$

Now look at the term $u = \sqrt{gh}$ in equation 3. As the incoming tide (u) begins to feel the shallowing bottom (d), it accelerates. Then, as u approaches $\sqrt{gh}$, the flow becomes critical, the tide forms a wave, and a wall of water or bore is formed (i.e., the wave crests but never breaks).

The speed where $u = \sqrt{gh}$ is critical. It is the one at which a discontinuity develops on the incoming wave

and the bore is formed.

Equation 3 could be expanded to show the effect of a narrowing estuary as well as a shallowing bottom (Tricker). However, sample calculations for Turnagain Arm show that the added terms change the results by only a few percent. Therefore, the effect is not discussed for this case.

A simpler form of equation 3 can be derived from first principles. In it the effect of the sloping bottom (d) is ignored. The result, where c is the speed of the bore, is:

4. $c = \sqrt{g(H + h)}$ (Tricker)

Surveyed sections of Turnagain Arm show an average depth ranging from 4.5 ft to 12 ft east of the mud flats (where the bore initially forms).

Observed bore heights in Turnagain Arm range from 1 to 2 ft at 4 to 6 mi/h to a reported height, under favorable conditions, of 6 ft. Since the 1964 earthquake, the height of the bore has been reported to be less by some residents.

Table 1.--Calculated values of speed of bore (c) with given heights of low-water depth (H) and bore height (h) using equation 4

H (ft)	h (ft)	c (mi/h)
4.5	1	9.0
	2	10.0
	6	12.5
6.0	1	10.0
	2	11.0
	6	13.5
12.0	1	14.0
	2	14.3
	6	16.0

Using equation 4, some sample calculations for Turnagain Arm were made and are shown in table 1. A depth in the arm of 4 to 6 ft and a bore height of 1 to 2 ft with a speed of 4 to 6 mi/h seem to be representative of the bores seen in recent times. However, the resulting calculation from equation 4 (table 1) shows the speeds to be high (10 to 13 mi/h) for the reported bore heights (1 to 2 ft) and bottom conditions.

These results may not be too far out of line, however. The heights, speeds, and depths of Turnagain Arm east of the surveyed section are all estimated. Hence, any of the parameters could be in error. Therefore, the calculated values do not seem too much out of line with the observed values, given the possible sources of error in the data.

The bore in Turnagain Arm is sometimes made more spectacular by an opposing wind--the wind causes the crest of the bore to become frothed. It could appear that this wind was the cause of the bore as it opposed the incoming tide.

The winds usually blow down Turnagain Arm toward Cook Inlet. They occur when a pressure differential develops between Prince William Sound in the Gulf of Alaska and Cook Inlet. Generally, a pressure differential of about 4 to 6 mb is needed between Cordova on the Gulf of Alaska and Anchorage on Cook Inlet. Windspeeds through Turnagain Arm can be in excess of 100 mi/h but are usually 20 to 30 mi/h.

The best time to observe the most spectacular bores is on spring tides, when the moon is at perigee, or closest to the Earth. At these times the water level is low enough so that the mud flats are exposed. Thus, the water is shallow enough for the bore to form.

Spring tides occur in conjunction with a full and new moon; however, the tidal differences are most pronounced at the new moon. The tidal difference is further enhanced when a new moon occurs in conjunction with the moon reaching perigee. Both of these events occur together about four times a year.

A survey of times of occurrence of a new moon over Anchorage for 1979 showed that half occurred when it was dark. This fact, combined with the approximate occurrence of maximum tidal difference and inclement weather in Turnagain Arm, partially explains why so few sightings of the bore are reported there. Also, in winter much of the Arm is covered by ice cakes which would dampen any waves or bores.

In conclusion, bore tides occur in the Anchorage, Alaska, area, particularly in Turnagain Arm. The primary causes of the bores are the great tidal differences in Cook Inlet and the shallowing bottom and narrowing estuary of Turnagain Arm. Opposing wind can enhance the bore but does not cause it. A few sample calculations showed general agreement with the few observations that have been made of the speed and height of the bores.

The occurrence of bores can be forecast; however, nighttime occurrences, inclement weather, and few observers have kept actual observations of the bore limited.

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ONE-FORTY CLASS COAST GUARD ICEBREAKER-TUGS

Lcdr. Lawson W. Brigham
and Ltjg. Michael N. Powers
Sturgeon Bay, Wis.

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The newest fleet of cutters--the 140-ft small icebreaker class--is unique in many ways to the Coast Guard. We believe that the wave of the future has arrived with the addition of these fine ships to the Ninth District icebreaking team. Physically large, minimally manned, and loaded with sophisticated electrical and electronics systems, the WTGB class cutter represents a stalwart professional challenge to the seaman as well as to the modern Coast Guard manager. Some might find good seamanship and sound management somewhat incompatible, but clearly aboard these cutters they are inseparable requirements. From our vantage point the onboard management of this complex shipboard system, particularly with regards to assigned personnel, will determine the future operational capability of this class.

From the outset the MOBILE BAY (fig. 5) has been found to be a most challenging vessel to handle. Sin-

Figure 5.--The large superstructure of the MOBILE BAY is apparent in this side view. The portable van on the fantail houses the diesel engine and compressor for the hull air lubrication system. U.S. Coast Guard Photo.

gle-screw, plenty of mass (662 tons vice 384 for the WYTM's) and a large superstructure make this cutter in many situations a very demanding ship to "drive." It has been remarked by several of our Great Lakes friends that "they forgot the hull when they put the bridge on this cutter." That may be overstating the case a bit, but the WTGB pilothouse, located unusually far forward, is large and spacious for such a relatively small vessel. It is an understatement when we say that the conning officer should monitor the wind's effect on the ship's large sail area and use it to good advantage.

Table 2.--Small icebreaking cutters on the Great Lakes[1]

	WLB Buoy tender	WTGB Icebreaker-tug	WYTM Harbor tug
Length, overall (ft)	180	140	110
Beam (ft)	37	37.5	27
Draft, full load (ft)	13	12.5	11
Displacement (tons)	1,025	662	370
Horsepower	1,200	2,500	1,000
Horsepower: displacement	1.17 : 1	3.78 : 1	2.70 : 1
Maximum speed (kn)	13	14.7	11.2
Main propulsion	Diesel electric	Diesel electric	Diesel electric

[1]From U. S. Naval Institute Proceedings, October 1980

With regards to the use of the ship's 2,500 hp the appropriate word is definitely judicious (table 2). The ice-strengthened one-forty hull can, in our judgement, easily take out a pier or crunch through the thin skin of a laker if one is not mindful of the capability of this cutter. Needless-to-say, common sense, finesse, and patience--nothing particularly extraordinary to the shiphandler--are the order of the day. But it is reassuring to know that you have a large rudder and that added horsepower in tight situations where one must "back and fill" to get around.

An intriguing characteristic of this class that will interest most seagoing types is that this vessel does not necessarily back to port. In fact, we operated MOBILE BAY for a full month before one of the conning officers coaxed the ship to port on a backing bell! Forget the book as this ship backs into the wind, provided it's blowing anything above 8 to 10 kn. The Navy ship-riders at refresher training had a difficult time believing what they were seeing.

Although the system was not intended as a thruster, it may well be possible to utilize the "bubbler" system (hull air lubrication system) as a limited shiphandling tool. The operation of the valves is not exactly quick acting--approximately 50 sec for full opening--so one cannot expect a burst of power. However, our observations during the following situations hint at such a use:

(a) Moored "starboard side to" the starboard forward and aft valves were opened and all lines were cast off. MOBILE BAY was thrust sideways in light ice against a 12- to 15-kn breeze off the port bow. That the ship could be pushed sideways at a slow speed under such conditions is remarkable.

(b) Approaching to moor "port side to" the ship was brought to a parallel position 30 ft off the pier. Upon opening the starboard valves the ship was thrust at a moderate speed toward the pier. However, sternway was detectable as the forward orifices force water toward the stem. A careful balance can be achieved by slowly turning the screw forward.

(c) We utilized the entire bubbler system to back into our track away from a pier in Escanaba, Mich., so as not to disturb the surrounding ice with our prop wash.

(d) At our moorings in Sturgeon Bay we are hemmed in astern by two wintering lakers and ahead by several commercial tugs. MOBILE BAY is moored port side to so the most practical way to get underway in ice is to back down on number three line. We first create a pool of water off the starboard bow with the bubbler and then use the port bow valves to "thrust" the bow out. This technique is effective and unusual, and it surely beats backing into 25 to 30 in of ice after springing out on number two.

Perhaps by now it is quite evident that there are many unconventional and interesting ways to handle the WTGB class cutter. To be honest, though, we are still very much in the learning stage, especially with regards to the use of the bubbler system.

There is no getting around the fact that this cutter can be a rough rider with significant wetness in a good seaway. One also has to get acclimated to the fact that a good sea can easily roll onto your forecastle very similar to any other tuglike design. We have also experienced a 60-degree roll aboard MOBILE BAY in 12 to 14 ft seas off Cape May. But, although wet and potentially uncomfortable in any seas approaching 8 ft (due primarily to the round "icebreaker" hull) in our judgement, the vessel is intrinsically safe. However, it must be kept in mind that severe icing could be a limiting factor during WTGB operations in near freezing environments. In any event many of our ideas on this subject will no doubt be covered in the final analysis of the class' seakeeping trials conducted aboard MOBILE BAY in the Atlantic in the fall of 1979.

Steering aboard this vessel is truly superb. Even though we have a beamy, double-ended hull the so-called "wandering" observed on the Wind class icebreakers is not evident in the WTGB. The 8-ft screw and large rudder (10-ft height/6-ft length) tend to a nice job of counteracting the massive windage of the superstructure. Additionally, during towing exercises with TAMAROA we detected no shear that could not be overcome by an amount of WTGB rudder angle. MOBILE BAY was able to maintain its heading even though TAMAROA was riding 520 ft off the port quarter.

We have had the opportunity to steam through several narrow openings with no serious handling problems. One particularly interesting situation that underscores the directional stability of the class occurred in Green Bay beneath a new highway bridge. A construction barge and one bridge abutment narrowed the main channel to approximately 44 ft. With little more than 3 ft to spare on each side MOBILE BAY tracked nicely through, although the bridge gang had a few anxious moments just believing the distance was enough! After that experience anyone would have confidence in the steadiness of their steering, if not their helmsmen.

Having sailed aboard KATMAI BAY last winter and conducted limited operations aboard MOBILE BAY we view the class as clearly superior to the WYTMs and WLBs as domestic icebreakers. In particular, the hull air lubrication system is an effective tool for

cleaning piers of ice, for helping to extract the ship, and for increasing hull effectiveness in snow-covered ice. A great deal more is to be learned and digested, but it is our hope that the initial 140 operators will be able to assemble an ice operations manual that will outline our collective experiences. It is our intent that such dissemination of information to future WTGB operators will cut down on "learning the hard way."

To be frank, this winter has been mild in comparison to last when KATMAI BAY was put to an excellent and demanding test (incidentally receiving a CG Unit Commendation for their efforts). However, here are several experiences of the past few months that hint at the icebreaking capability of the WTGB (figs. 6 and 7):

(a) MOBILE BAY walked through 18 to 20 in of hard ice in Escanaba, Mich., at 7 kn without using the bubbler system.

(b) We broke through 3- to 4-ft windrows without the bubbler and after only backing off once.

(c) When necessary, we are able to create a track width on one pass of at least 200 ft in medium ice.

Figure 6.--The MOBILE BAY rides up on the ice during an icebreaking mission. U.S. Coast Guard Photo.

Figure 7.--Ice around Minneapolis Shoal Light on Green Bay near Escanaba. An example of the mission of the MOBILE BAY. U.S. Coast Guard Photo.

Search and rescue is another mission that requires WTGB utilization on the Great Lakes. The class is an adequate SAR platform expecially in terms of electronic capability although roll characteristics and forecastle wetness limit overall performance. Increased horsepower, a low fantail, and the previously mentioned excellent steering speak well for the WTGB as an improved towing cutter for small vessels up to 2,500 tons. Response during controlled speed up and slow down was considered outstanding during our towing of TAMAROA. However, one apparent deficiency is that the conning officer cannot view the deck crew aft and must rely solely on another Officer of the Deck (OOD) stationed aft of the stack.

One point of interest concerns fuel conservation in the class. The ship's maximum speed is 14.7 kn with both main diesels and main generators on the line. Consumption is roughly 180 gal per hr (no one ever said icebreaking was inexpensive!). However, one main system will push us comfortably along at 12.0 kn cutting our fuel bill in half. Obviously, the power curve in its upper limits is very steep and all that reserve horsepower will be used only when icebreaking. This is an important factor to bear in mind when steaming on ice-free and nonrestrictive waters.

As a working harbor vessel used for various marine environmental protection missions, the class has several distinct attributes: increased fire-fighting capability (two monitors delivering 250 gpm apiece with a hc :izontal range of 210 ft); an ability to effectively tow alongside; improved bridge visibility; and significantly increased endurance. Looking offshore, under favorable weather conditions these cutters might be used in future operations involving marine safety on the continental shelf--such as surveillance cf and fire fighting on offshore structures.

Training is one area in which we strongly feel the ship has excellent potential. The spacious bridge and large engineering spaces make the WTGB an ideal laboratory for introductory navigation and engineering indoctrination. Our experiences have shown that a sound knowledge of basic deck seamanship is essential to the safe handling of this vessel. In addition, the diesel-electric plant with a fair amount of redundancy can provide operational training in engineering system tracing, isolation, and repair.

The very spacious bridge has a well thought out arrangement. With a two-man watch in the pilothouse it is imperative to have easy access to all communications and navigation equipment. The current configuration is nearly optimal and is consistent with the low manning concept of the class. Of note is the placement of two radar indicators (AN/SPS-64 system) along the forward bulkhead. Although this may seem to be a luxury to some, the inherent redundancy of the system is comforting especially since we have no billet for an electronic technician. This indicator arrangement also allows for something that might be appropriately termed "concurrent observational capability." The Commanding Officer and the OOD can simultaneously view and interpret contacts on separate indicators--a highly desirable feature.

The pilothouse is designed so that all maneuvering and operation of the ship can be accomplished without stepping outside into the sometimes unbearably cold weather. On each wing of the enclosed bridge there is a console with throttle and nonfollowup rudder controls, as well as sliding gyro repeaters. Our experiences have shown, however, that when mooring or working close aboard another ship, it is far better and safer for the conning officer to step outside onto the catwalk. Certainly one has an improved view of the surrounding ice cushion and, importantly, an immediate feel for the wind's effect on the superstructure.

All in all the most remarkable aspect of the bridge is its sheer size. During a recent dependent's cruise there were 30 sightseers in the pilothouse without in-

terference to MOBILE BAY's safe operation. Many sailors would find it amusing that we muster the ship's company at foul weather parade on the bridge. We have found no other space more suitable.

The low manning of the 140's requires that considerable responsibility be placed on junior personnel. For example, one of our four qualified underway OODs is the Bosuns Mate 3d Class (BM3); the others are the Lieutenant Junior Grade (LTJG), Chief Bosuns Mate (BMC), and Quartermaster 1st Class (QM1). Many skeptics might question the wisdom of giving a third class petty officer control of a 140-ft cutter. But why not? In this time of generally poor retention of enlisted personnel, challenges such as this may well be what is needed. And, indeed, this young man has risen to the occasion and has done an extremely competent job. Now, of course, we groomed him for the task by sending him to every related service school during a lengthy precom. Characteristically, our Navy friends in Norfolk needed some arm twisting to allow a BM3 to take "their" rules of the road course with a group of 0-4's and 0-5's.

The normal underway watch consists of one Engineer of the Watch (EOW) in the Engineering Control Center, a helmsman, and the OOD. Four seamen stand 2-hr helm watches and act as partial lookouts. When working in ice the structure changes to include a Command Duty Officer (CDO). The Commanding Officer and Executive Officer act as CDO and the three OODs rotate accordingly. No matter what the situation, the underway OOD on a 140 is a very busy individual. He does all the log entries, is responsible for the safe navigation of the ship, plots all contacts, acts as lookout, handles all communications, and is responsible for the ship's routine. This situation without a Quartermaster of the Watch is akin to the WPBs, but bear in mind that this cutter is significantly larger.

The engineering watchstander stands watch in the Engineering Control Center, not the engineroom. He makes an hourly security round of all engineering spaces.

Anyone familiar with the WYTM's would detect immediately on the WTGB a vastly improved interior. All living spaces are either above or on the main deck. Excellent noise suppression and superior temperature and humidity control make life aboard very comfortable, especially when icebreaking. Of interest, for over 9 weeks our entire complement lived aboard while operating along the East Coast. Every crewmember was genuinely pleased with the high standards set with this class. Brightly colored paneling, art work, and built-in stereos add a touch of class and certainly impress those assigned. The comfortable surroundings most definitely enhance the pride this crew has for its unit.

If there is a fault with the accommodations it is the lack of extra berthing. Obviously, one cannot increase the number of billets when the ship is provided with 17 racks for a 17-member crew. Substantial structural modifications might be required should this become a recurring problem. Quite evident is the fact that it is impossible to provide adequate berthing for temporary personnel, reservists on active duty, new PCS crewmembers reporting early and the like. We would ask also where are we to berth law enforcement personnel, regatta officials, or trainees? This lack of berthing is one indicator of the inflexibility of the personnel situation aboard a minimally manned cutter.

Because of the small crew of the WTGB class, good personnel management is absolutely crucial. The loss of even one worker has far reaching impact on what can be done in a day. Yet, emergencies do develop that require an individual's absence, and some liberty and leave must be scheduled. Careful scheduling and analysis with respect to the ship's operational commitments are required to strike a satisfactory balance between leave and providing for the safe, continued operation of the ship.

Due to the critical importance of each member of the ship's crew, the prior training that each receives is very important. With the heavy workload that is typical of the class, extensive on-the-job training comes dearly. Attendance at various service schools is mandatory. But one cannot afford to send members of the crew to the required schools once they report aboard. The requirements necessitate roughly 3 to 4 weeks of service schools for the average crewmember. Some of the engineering petty officers require 2 mo. With the new minimally manned ships, the service must now come to grips with the necessity of providing the required training prior to the crewmember reporting aboard. If we do not choose to accept this approach, the operational capability of this class may be impaired.

The 140's limited manpower does not include any yeoman or storekeepers. The trusty Executive Officer is a striker at both of these administrative rates. Fortunately, the group office provides support in these areas, but the administrative details and supply problems along with a myriad list of collateral duties make the Executive Officer the key man in this managerial environment.

From our viewpoint the WTGB is clearly superior to the WYTM and is a vessel of which the Coast Guard can justly be proud. Many talented military and civilian personnel created an exceptionally effective icebreaker for its length and horsepower. We suggest that this is perhaps the most cost-effective vessel for the job at hand. Certainly there are, however, design constraints which must be considered during use in other mission areas.

It is to our fellow Service personnel that we address our final thoughts. This cutter class is a challenge to each individual onboard--from the most junior nonrated to the commanding officer. All hands are given, out of necessity, a great deal of responsibility. This is certainly as it must be for the 17 assigned to operate this sophisticated cutter in the traditional manner of our Service. To you officers with an interest in the WTGB, it is a grand opportunity for adventuresome, challenging, and rewarding duty. Our initial observations lead us to believe that not only is this ship a great test of seamanship but also you better have your management ideas clearly in focus. Time, people, and dollars all have to be marshalled together in careful balance to keep these "buck forties" in business.

Lieutenant Commander Brigham is now assigned to the Naval War College.

Hints to the Observer

AIR TEMPERATURE AND DEW POINT

The air temperature and the dew-point temperature are two items used by the weather forecaster when he makes his evaluation of the weather situation. Temperature and dew point must be evaluated from the free air if they are to be of maximum value to the forecaster. Aboard ship, heat from the stack and from the ship itself can introduce errors into psychrometric readings unless proper precautions are taken. Psychrometric readings should be taken to windward in a shaded location. If the wick of the wet bulb is moistened 2 or 3 min before making the observation, it will cool to near its final reading, and less whirling of the psychrometer will be necessary. Whenever the apparent wind is 10 kt or higher, psychrometric readings can be made without whirling the psychrometer. Merely hold the thermometers into the wind until the wet-bulb and dry-bulb readings remain steady. Observers using the aspirated psychrometer can use the same technique by removing the plastic cover over the thermometer bulbs and holding the instrument into the wind. Operation of the fan is not necessary when the air movement past the thermometers is at least 10 kt.

Occasionally both bulbs will become wet from spray or rain. This will result in erroneous readings if the dry bulb is left moist. In these cases the dry bulb should be dried with a clean cloth and another reading should be taken. In very rough seas it may not always be possible to obtain an accurate reading from the windward side because of spray. When these conditions occur the observer should attempt to get the readings on the leeward side, making sure that the thermometers are kept away from any source of heat.

When the air temperature is near the freezing point, the wet-bulb temperature will, in many cases, be below 0°C. In these cases the wet bulb should be moistened 10 to 15 min before observation time and exposed to the free air. As the water evaporates from the wick the wet-bulb temperature will drop to 0°C and remain at that temperature for several minutes. Once the water in the wick has frozen and all latent heat has been dissipated the temperature of the wet bulb will drop below 0°C to the true wet-bulb value.

Additional Hints for Accurate Readings

1) Change the wick whenever it becomes soiled (at least once a week).

2) Be sure that the scale markings on the thermometers are legible. If they become difficult to read, have the Port Meteorological Officer replace them for you.

3) Apply clean water to the wick when moistening the wet bulb.

Tips to the Radio Officer

Larry Murphy
National Weather Service, NOAA
Silver Spring, Md.

CORRECTIONS TO WORLDWIDE MARINE WEATHER BROADCASTS (JUNE 1981 EDITION)

Page 9
1-0240 New Orleans, LA , USA NMG
Change 1552 to 1550.

Page 16
1-0750 Walvis Bay, South Africa ZSV
Change (A2) to (A1)
On second line of schedule add "W" after "LR".
Add new line: On receipt 500 W.

Page 17
1-0770 Pt. Reyes, CA, USA NMC
Add area (d) Offshore waters from St. James to Pt. St. George.
Change last two lines of schedule to read:
0400, 1830 472 W^2, S^2, F^2

Page 18
1-0930 Honolulu, HI, USA NMO
On first line of schedule change 2000 to 2100.

Page 34
2-0031 Portsmouth, VA, USA NMN
Delete last line of schedule and add:
1730 8765.4 (A3J) Forecasts[2]
13113.2 (A3J)
17307.3 (A3J)

Page 38
2-0430 New Orleans, LA, USA NMG
On third line of schedule add 1750.
On fifth line of schedule delete 1750.

Page 39
2-0445 Grand Isle, LA, USA NMG15
Change times to 1035, 1635, and 2235.

2-0475 Port Aransas, TX, USA NOY3
Change times 1040 to 1100, 1640 to 1700, 2240 to 2300, 1030 to 1040, 1230 to 1240, 1630 to 1640, and 2230 to 2240.

Page 45
2-1120 Walvis Bay, South Africa ZSV4

Change schedule to:

0933, 1633	1765 (A3) 4357.4 (A3J) 8718.9 (A3J) 161.9MHz (F3)	F,W
1315 On receipt	1765 (A3) 2182 (A3H) 156.8MHz (F3)	F,W W

Page 46

2-1160 San Francisco, CA, USA NMC

At bottom of page 46 delete times 1230, 1630, 2230 and add

1630, 2230	8765.4 (A3J) 13113.2 (A3J)	F,W

Page 47

2-1230 Kodiak, AK, USA NOJ

Change 1330 to 1300.

2-1280 Ketchikan, AK, USA NMJ

Change call sign to NMJ2.

Page 48

2-1420 Astoria, OR, USA NMW

Add new line: 0515, 1715 157.1MHz S,F

2-1451 Coos Bay, OR, USA NOE

Add new lines 0520, 0533, 0540, 1720, 1733, 1740 157.1MHz F

Add new station;

2-1440 Portland, OR, USA NMW44

Area: Coastal waters, Tatoosh Is. to Pt. St. George

1733, 1740 157.1MHz S,F

2-1470 Humboldt Bay, CA, USA NMC11

Change 1615 to 1515; delete last line.

2-1481 Monterey, CA, USA NMC6

Change 1615 to 1645; delete last line.

Page 49

2-1530 Honolulu, HI, USA NMO

Change footnote 1 to read: Used at 0545 and 1145 only

Change footnote 2 to read: Used at 1745 and 2345 only

Page 59

3-0250 Sofia, Bulgaria LZA8

Delete station and replace with:

3-0250 Sofia, Bulgaria LZJ2

Area:

(a) 30°N 20°W - 28°N 34°E, 60°N 63°E 64°N 45°W

(b) 36°N 14°E - 36°N 81°E, 47°N 33°E 47°N 13°E

0415, 0950	Surface analyses area (a)
0435, 0735, 1030, 1330	Surface analyses area (b)
0800	Test chart

Page 65

Add new station:

3-0450 Belloto, Chile CCV6

Frequency (kHz): 4379, 22070

0200	Sea state prog.
1430, 2310	Surface anal.
1920	Nephanalysis
1940	Sea state anal.
2330	Surface prog.

Page 72

Add new station:

4-0135 Guam, Mariana Is. NRV

Frequency (kHz):	13077
1800, 2300	Forecast and warnings
Frequency (kHz)	22567
0400, 1400	Forecast and warnings

A complete listing of all changes to the new edition of Worldwide Marine Weather Broadcasts is available from your Port Meteorological Officer or upon request from:

National Weather Service, NOAA
Marine Weather Services, W162
8060 13th Street
Silver Spring, MD 20910

Marine Observations Program

J.W. Nickerson
National Weather Service, NOAA
Silver Spring, Md.

MARINE OBSERVATIONS PROGRAM

At 0000 on January 1, 1981, many of the land stations and ships at sea will commence sending weather observations in the new synoptic code--many will not. Those that send weather reports to OBS METEO WASHDC and do not have the new code manuals and forms should continue using the old weather observation system and forms until they are replaced.

The National Meteorological Center at Suitland, Md., is prepared to accept weather observations for a limited time in either the old or the new synoptic code format. Data in either format will be fully utilized in preparing weather forecasts and warnings for the ships at sea.

There are some forms that have been stamped "Obsolete after January 1, 1982." Please just line through this and use the forms until replaced.

In previous Log articles we have said that, when analyzed, there isn't very much difference from the observer's standpoint between the old and the new codes except in the format or arrangement of the data. Let's go through both and compare these differences.

Present Code

$99L_aL_aL_a$	$Q_cL_oL_oL_o$	$YYGGi_w$	Nddff	VVwwW
PPPTT	$N_hC_LhC_MC_H$	D_sv_sapp	$OT_sT_sT_dT_d$	$1T_wT_wT_wt_T$
$21_sE_sE_sR_s$	$3P_wP_wH_wH_w$	$d_wd_wP_wH_wH_w$		ICE $c_iS_ib_iD_iz_i$

New Code

Section 0:	D....D	$YYGGi_w$	$99L_aL_aL_a$	$Q_cL_oL_oL_o$
Section 1:	i_Ri_xhVV	Nddff	$1s_nTTT$	$2s_nT_dT_dT_d$
	4PPPP	5appp	$7wwW_1W_2$	$8N_hC_LC_MC_H$
Section 2:	$222D_sv_s$	$0s_nT_wT_wT_w$	$2P_wP_wH_wH_w$	$3d_{w1}d_{w1}d_{w2}d_{w2}$
	$4P_{w1}P_{w1}H_{w1}H_{w1}$	$5P_{w2}P_{w2}H_{w2}H_{w2}$	$6I_sE_sE_sR_s$	
	ICE	$c_iS_ib_iD_iz_i$		

The new code is divided into three sections. I don't know why they started with Section 0.

Section 0 contains the ship's call sign, D....D, and data on the time and position of the ship. This is called the identification section and all of the groups are required in the log or record and in the radio message. The only new group is the ship's call sign, D....D, which is now a part of the body of the radio message. All of the other groups are the same as the present code, just rearranged.

Section 1 has a few differences. The i_R in the first group is an indicator for the precipitation group, and it has been preprinted on the log for the convenience of the observer. The next element of the same group, i_x, indicates if the weather group is included in the message. Still in the first group of Section 1, the h and VV are the same as in the present code, but the format has been rearranged.

The second group in Section 1, Nddff, is the same as in the present code: cloud amount, direction, and force of the wind. The groups in Section 0 and the first two groups of Section 1 are required and must be included in each message. However, beyond this point each group is numbered and, if there is nothing to report of significance, the group may be omitted without fouling any of the other groups.

One of the biggest changes for the better in the new code is the expansion of the temperature groups: $1s_nTTT$, $2s_nT_dT_dT_d$, and $0s_nT_wT_wT_w$. The groups are all numbered and s_n is the symbol to indicate temperature above or below zero degrees celsius (0 or plus is coded 1, minus is coded 0). The temperatures are now in tens, units, and tenths of a degree. I don't think anyone will miss the temperature procedures in the present code.

The pressure, PPPP, and pressure tendency, ppp, have both been expanded so there is less confusion. As the ppp now includes tens, units, and tenths, an extra group for pressure change over 9.9 mb is not required.

There is an additional past weather element so the weather can be more adequately described. The code is the same for both past weather elements.

The cloud group is the same, except now the group is numbered. The low cloud height, h, has been moved into the first group of Section 1.

Section 2 contains the marine groups and is identified by the indicator 222. Notice that the group numbers commence again at zero after the 222 group. That is why the 222 group must be included in all messages with marine data included.

The various observational elements in the wave groups are also expanded. P_wP_w is now recorded in seconds rather than in a code as in the present code. Height is still in half-meters. There is now provision to observe and record two swell trains including direction, $3d_{w1}d_{w1}d_{w2}d_{w2}$, and period and height, $4P_{w1}P_{w1}H_{w1}H_{w1}$ $5P_{w2}P_{w2}H_{w2}H_{w2}$.

The ice groups are the same except for renumbering and rearrangement.

That is all the changes. Not really very many and most of them result in an improvement in clarity and observing procedures. As you become familiar with the new flexibility this new code format allows, I am sure you will like it.

Again, if you do not have the new manuals, forms, and other materials on January 1, 1982, just continue with your present forms until they are replaced.

We have a few complaints that sometimes this magazine and the manuals and other materials are not widely distributed aboard ship. We, of course, can only point out that all of the observers and the radio officer should see these things as soon as possible because there are articles that affect their performance in each issue.

ATMOSPHERIC PRESSURE ERRORS

Here is a new service that you should find helpful. During the process of weather map analysis the National Meteorological Center analysts note approximate

atmospheric pressure errors in some ships when compared to other ships in the vicinity. If your ship is on the list (table 3), you should seek the assistance of a Port Meteorological Officer at your next port of call to calibrate the barometer. Note that the average pressure error in table 3 is only approximate. You should not attempt to readjust your barometer based only on this information.

Table 3.--Approximate atmospheric pressure errors

Name (Country)	Call letters	No. of erroneous reports	Average pressure error(mbs)
Atlantic Ships			
IRISH PINE (Ireland)	WIDB	4	-3
Unknown (USSR)	ENVK	3	+12
Unknown (Estonia)	ESBS	3	+3
OSTROV SIBIRIAKOVA (Estonia)	ESKM	6	+5
OSTROV BERINGA (Unknown)	EWAF	6	+6
OSTROV KOTLINE (USSR)	EWJT	4	+3
PROFESSOR MESSIATSEA (USSR)	EWVS	3	+3
Unknown (Japan)	JLFC	4	+3
Unknown (USA)	NJAG	3	-4
Unknown (Sweden)	SHJA	3	-4
Unknown (USSR)	UFLR	7	+5
Unknown (USSR)	UHMC	4	+4
Unknown (USSR)	UIHF	3	+3
Unknown (USSR)	UIHS	6	+4
PYATIDECYATILETIE SOVETSKOI GROUZZI (USSR)	UJRO	4	+5
LIVNY (USSR)	UKMB	4	+3
Unknown (USSR)	UMRK	4	+3
Unknown (USSR)	UNXZ	13	+3
INGOUR (USSR)	UPDD	4	+4
Unknown (USSR)	UPSP	4	+4
ROUMBOULA (USSR)	USMB	12	+6
DROUJBA (USSR)	USQF	3	+4
Unknown (USSR)	USTJ	7	+5
ALEXANDRE GUERTSEN (Russian)	UTNC	3	+3
FRITZ HEKKERT (USSR)	UTNI	3	-3
Unknown (USSR)	UUVU	10	+6
KREMENTCHOUG (USSR)	UUZM	4	+4
IVAN POLZOUNOY (USSR)	UVMR	4	+3
VASSILII FESSENKOV (USSR)	UWDP	3	+4
Unknown (USSR)	UWYL	3	+8
Unknown (USSR)	UYDJ	11	-3
ILYA REPINE (Unknown)	UYJA	6	+3
NIKOLAI SIPIAGUINE (Unknown)	UZFP	7	+6
Unknown (Yugoslavia)	YUEN	4	+4
CASTELLA (Liberia)	5LYZ	15	-5
ORE STRUNS (Liberia)	5MCX	4	-8
Pacific Ships			
Unknown (Liberia)	A8GI	3	-4
Unknown (China)	BPLO	4	+3
Unknown (Philippines)	DZDV	5	+4
Unknown (Russian)	ENBI	6	+7
Unknown (USSR)	ENPP	3	+6
SROCCO (Panama)	HOEJ	10	+4
Unknown (Panama)	HOTP	14	+4
MUNETAMA MARU (Japan)	JIFS	21	+3
Unknown (Japan)	JHJS	7	+3
CHIHIROSAN MARU (Japan)	JIFS	5	+3
Unknown (Japan)	JJIL	6	-3
Unknown (Japan)	JKMF	5	+4
Unknown (Japan)	JLEX	6	+4
HAWAIIAN ENTERPRISE (USA)	KNLO	3	erratic
Unknown (Norway)	LKQN	4	-5
BUNKER ESSO (Denmark)	OXFB	3	-6
OSTROGOJSK (USSR)	UNNJ	3	+5
KAPITAN VASSILEUSKII (Unknown)	UTUB	6	erratic
ALEXANDRE VERMICHEN (USSR)	UTUH	4	+5
Russian (Unknown)	UWAA	22	+4
KIDRIC B. (Yugoslavia)	YTYJ	4	+4

Hurricane Alley

Dick DeAngelis
Environmental Data and Information Service, NOAA
Washington, D.C.

GLOBAL TROPICAL CYCLONES
JULY AND AUGUST 1981

A total of 20 tropical cyclones developed in the tropical oceans during this 2-mo period. This compares to 16 during the same period last year. The western and eastern North Pacific were the most ac-

Table 4.--Global tropical cyclone summary, July and August 1980

No.	Name	Peak Intensity	Est. max. wind (kn)	Est. min. sea-level pressure(mb)	Basin	Dates
1.	Darby	T	45	--	E. North Pacific	July 1-3
2.	Ida	T	60	980	W. North Pacific	July 5-11
3.	Estelle	T	40	--	E. North Pacific	July 11-13
4.	Joe	H	105	940	W. North Pacific	July 16-23
5.	Frank	T	45	--	E. North Pacific	July 18-22
6.	Kim	H	130	908	W. North Pacific	July 19-27
7.	Georgette	H	65	--	E. North Pacific	July 28-31
8.	Lex	H	80	962	W. North Pacific	July 29-Aug. 7
9.	Howard	H	90	--	E. North Pacific	July 31-Aug. 7
10.	Allen	H	165	899	North Atlantic	Aug. 1-11
11.	Isis	H	85	--	E. North Pacific	Aug. 5-11
12.	Marge	H	110	944	W. North Pacific	Aug. 7-15
13.	Bonnie	H	85	975	North Atlantic	Aug. 14-19
14.	Charley	H	70	989	North Atlantic	Aug. 20-25
15.	Javier	H	100	--	E. North Pacific	Aug. 22-29
16.	Norris	H	90	950	W. North Pacific	Aug. 23-28

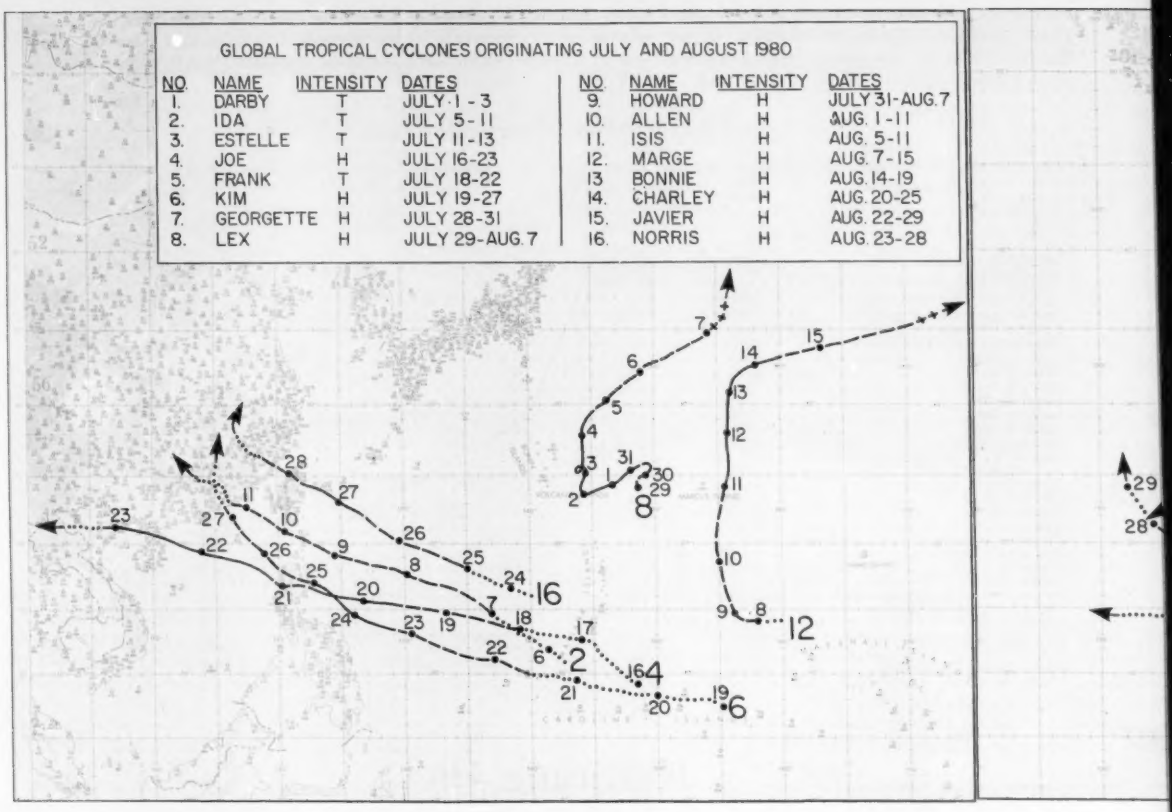

GLOBAL TROPICAL CYCLONES ORIGINATING JULY AND AUGUST 1980
NO. NAME INTENSITY DATES
1. DARBY T JULY 1 - 3
2. IDA T JULY 5 - 11
3. ESTELLE T JULY 11 - 13
4. JOE H JULY 16-23
5. FRANK T JULY 18-22
6. KIM H JULY 19-27
7. GEORGETTE H JULY 28-31
8. LEX H JULY 29-AUG. 7
9. HOWARD H JULY 31-AUG. 7
10. ALLEN H AUG. 1-11
11. ISIS H AUG. 5-11
12. MARGE H AUG. 7-15
13 BONNIE H AUG. 14-19
14. CHARLEY H AUG. 20-25
15. JAVIER H AUG. 22-29
16. NORRIS H AUG. 23-28

Figure 8.--Global tropical cyclone tracks, July and August 1980.

tive, with all but two storms coming to life in these basins; the other two sprang up in the North Atlantic. Seven of the storms reached typhoon or hurricane strength, and 13 of them formed in August. Descriptions of these tropical cyclones can be found in the appropriate Rough and Smooth Logs of this issue.

GLOBAL TROPICAL CYCLONES JULY AND AUGUST 1980

Of the 16 tropical cyclones that developed during this period, all but three came to life in the eastern or western North Pacific; those three were spawned in the North Atlantic in August (fig. 8). July was slightly more active with nine storms, while seven storms during the 2 mo roamed the eastern North Pacific. Twelve of the systems attained typhoon or hurricane strength (table 4), twice the amount of this year. The strongest storms were hurricane Allen of the North Atlantic with 165-kn winds around an 899-mb center, and typhoon Kim with 130-kn winds around a 908-mb center.

GLOBAL ACTIVITY - 1965-1980

Table 5 presents an updated version of global tropical cyclone statistics through 1980. This now gives us a good 16 years' worth of data on a global scale. This is only possible because of the excellent cooperation of the meteorological services of Australia, New Zealand, New Hebrides, New Caledonia, Fiji, Mauritius, Reunion, India, Hong Kong, the United States, and the Joint Typhoon Warning Center. In comparing this table with the one published back in the July 1978 Mariners Weather Log (Vol. 22, No. 4), which covered 1965-1977, the global averages for both tropical cyclones and hurricanes remained exactly the same.

TROPICAL CYCLONE WATCH - 1981

The tropical cyclones that have developed through November 1981 appear in table 6. This list is preliminary.

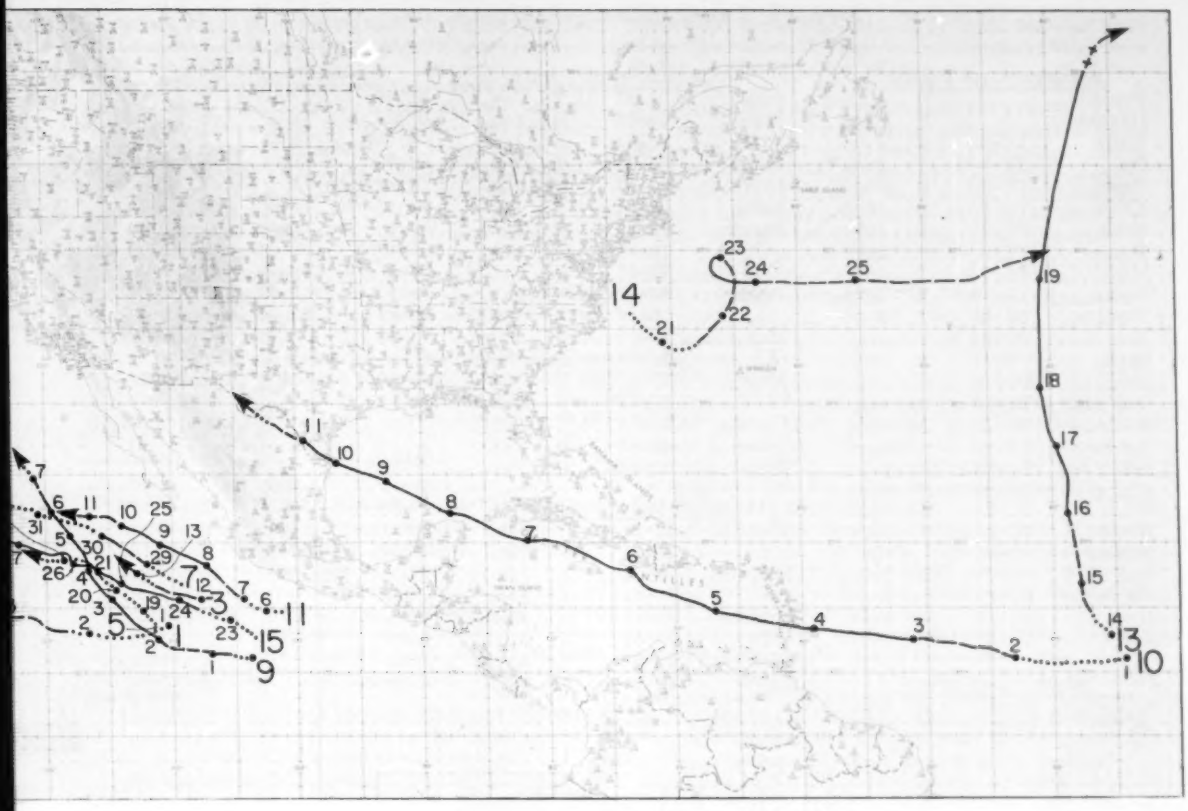


Table 5.--Tropical cyclones, 1965-1980

Month	North Atlantic	Eastern North Pacific	Western North Pacific	North Indian	South Indian	Australia-South Pacific	Total	Average
January	1(0)	0(0)	11(6)	2(1)	34(20)	62(27)	110(54)	6.9(3.4)
February	0(0)	0(0)	4(1)	0(0)	37(18)	54(21)	95(40)	5.9(2.5)
March	0(0)	0(0)	7(2)	0(0)	25(8)	48(25)	80(35)	5.0(2.2)
April	0(0)	0(0)	14(11)	4(2)	11(3)	22(7)	51(23)	3.2(1.4)
May	3(1)	7(5)	19(12)	16(6)	3(0)	4(3)	52(27)	3.3(1.7)
June	9(4)	31(13)	24(13)	6(1)	0(0)	0(0)	70(31)	4.4(1.9)
July	16(8)	52(22)	72(43)	2(0)	1(0)	2(0)	145(73)	9.1(4.6)
August	42(29)	63(39)	78(44)	2(1)	1(0)	0(0)	186(113)	11.6(7.1)
September	54(33)	46(23)	80(55)	12(4)	2(0)	0(0)	194(115)	12.1(7.2)
October	25(15)	26(12)	61(47)	19(7)	7(3)	4(1)	142(85)	8.9(5.3)
November	6(4)	6(1)	40(23)	24(10)	10(5)	18(7)	104(50)	6.5(3.1)
December	1(0)	0(0)	14(5)	13(4)	29(9)	38(17)	95(35)	5.9(2.2)
Total	157(94)	231(115)	424(262)	100(36)	160(66)	252(108)	1,324(681)	
Average	9.8(5.9)	14.4(7.2)	26.5(16.4)	6.3(2.3)	10.0(4.1)	15.8(6.8)	82.7(42.3)	
Percent hurricane	59.9	47.6	61.8	36.0	41.0	42.9	51.4	

Table 6.--World tropical cyclone watch, 1981

Western North Pacific			
Freda		H	March
Gerald		T	April
Holly	TC-3	T	April
Ike	TC-4	T	June
June	TC-5	H	June
Kelly	TC-6	H	June
Lynn	TC-7	T	July
Maury	TC-8	H	July
Nina	TC-9	T	July
Ogden	TC-10	T	July
Phyllis	TC-12	T	Aug.
Roy	TC-13	T	Aug.
Susan	TC-14	T	Aug.
Thad	TC-15	H	Aug.
Vanessa	TC-16	T	Aug.
Warren	TC-17	T	Aug.
Agnes	TC-18	H	Aug.
Bill	TC-19	H	Sept.
Clara	TC-20	H	Sept.
Doyle	TC-21	H	Sept.
Elsie	TC-22	H	Sept.
Fabian	TC-23	T	Oct.
Gay	TC-24	H	Oct.
Hazen	TC-25	H	Nov.
Irma	TC-26	H	Nov.
Jeff	TC-27	T	Nov.

North Indian Ocean			
--	27-81	T	Oct.
--	29-81	H	Nov.

Australia-South Pacific			
Arthur	02-81	T	Jan.
Mabel	03-81	H	Jan.
	05-81	H	Jan.
Betsy	07-81	T	Jan.
Cliff	08-81	H	Jan.
Eddie	09-81	T	Feb.
Daman	11-81	T	Feb.
	12-81	T	Feb.
Neil	13-81	H	Feb.
Freda	14-81	H	Feb.
	15-81	T	March
Max	17-81	H	March
	18-81	T	March
Fran	19-81	T	March
	20-81	T	March
Klara	21-81	T	April
Alex	26-81	H	Oct.
Bessi	28-81	H	Nov.

South Indian Ocean			
Florine	01-81	H	Jan.
	04-81	T	Jan.
Helyette	06-81	T	Jan.
	10-81	T	Feb.
Johanne	16-81	H	March
Olga	22-81	H	April
Lisa	23-81	T	April
Paddy	24-81	T	May

Eastern North Pacific			
Adrian	TD-1	T	May
Beatrix	TD-2	H	June
Calvin	TD-3	T	July
Dora	TD-4	H	July
Eugene	TD-5	T	July
Fernanda	TD-7	H	Aug.
Greg	TD-8	T	Aug.
Hilary	TD-10	H	Aug.
Irwin	TD-11	T	Aug.
Jova	TD-12	H	Sept.
Knut	TD-13	T	Sept.
Lydia	TD-14	T	Oct.
Max	TD-15	T	Oct.
Norma	TD-16	H	Oct.
Otis	TD-17	H	Oct.

North Atlantic			
Arlene		T	May
Bret		T	June
Cindy		T	Aug.
Dennis		H	Aug.
Emily		H	Aug.
Floyd		H	Sept.
Gert		H	Sept.
Harvey		H	Sept.
Irene		H	Sept.
Jose		T	Oct.
Katrina		H	Nov.

On the Editor's Desk

NEW DEVICE AIDS COAST GUARD IN AIR SEARCHES

After proving itself in two rescues off the California coast, a new heat-sensing device is being sent to New York for a 6-mo evaluation at the Coast Guard Air Station in Brooklyn. The Forward-Looking Infrared (FLIR) sensor is enclosed in a pod and mounted on the nose of an HH52-A helicopter. It "sees" images by measuring the amount of radiation or energy emitted by various objects in a manner somewhat like a television camera detects light as an image. FLIR can differentiate between objects with as little as 0.1°C temperature variation.

The electronic, heat-seeking sensor is similar to those used in some missile guidance systems. It projects an image onto a monitor in the helicopter's cockpit or in the aft section where a crewmember can monitor it. The sensor, much more powerful than the human eye, projects images in normal proportions, or can magnify them three times. The images are comparable in clarity to a black-and-white television. They are recorded on a video cassette and can be replayed later if necessary.

The Coast Guard has been studying the possibility of using limited-visibility detection devices since 1972. The FLIR prototype, developed by the Northrop Corp. for the Coast Guard, has been in operation at the Coast Guard Air Station in Los Angeles since December 1980.

In its West Coast trial the new device is credited with saving the lives of three men after their fishing boat sank off the California coast in July. FLIR cut through the fog to pick out the men at a distance of 1 mi despite darkness, visibility of less than 1/4 mi, and a cloud ceiling of 400 ft. The men were in the second stage of hypothermia when they were plucked from the water. Their chances of survival without FLIR would have been slim, according to the helicopter pilot.

In an earlier case two men adrift in a 9-ft open boat were spotted by FLIR at an altitude of 500 ft and a distance of 3 mi.

During a 6-mo winter evaluation FLIR will participate in a project at the Coast Guard Research and Development Center in Groton, Conn., and will also be used to conduct ice observation patrols on the Great Lakes. After a subsequent evaluation at a high-traffic southern air station, FLIR systems are expected to be installed in the Coast Guard's new HH65 Aerospatiale Dolphin helicopters.

NOAA EXPANDS WATCH OF GULF COAST WEATHER

A team of government satellite experts now maintains a 24-hr a day watch of Gulf of Mexico weather

conditions aimed at expanding weather forecasting and warnings provided coastal and offshore areas from Florida to Mexico.

Six meteorologists and an oceanographer are staffing a Satellite Field Services Station that will provide Gulf Coast weather stations with weather and marine information gathered by satellite. The station at Slidell, La., will pay special attention to conditions affecting small craft and helicopter traffic associated with offshore oil platforms.

NOAA Administrator John V. Byrne said an Ocean Services Unit will be formed at Slidell later this year. It will be staffed by marine weather specialists and will broaden the marine forecasts that the New Orleans area National Weather Service Office now provides the Gulf marine community.

The two units will constitute an Ocean Services Center, the second of nine such planned facilities along the U.S. coastline. The first unit was established in Seattle, Wash., earlier this year.

HUMAN ERROR CAUSES MOST MARINE COLLISIONS

Human error in navigation or maneuvering causes two-thirds or more of marine collisions, the National Transportation Safety Board has reported.

A Safety Board special study showed that 67 percent of all U.S. ship collisions from 1970 through 1979 were attributed by the Coast Guard to human error. Of 33 major collisions investigated by the Safety Board from 1970 through 1980, 73 percent resulted from improper navigation.

Equipment failure was cited by the Coast Guard in 7.4 percent of U.S. ship collisions and in 18 percent of the Safety Board collisions investigated.

The special study developed a profile of a major marine collision from among those investigated by the Board. The typical collision was in a U.S. inland waterway where inland rules of the road were in effect, and outside an area served by active Vessel Traffic Service. Typical conditions were clear visibility, radar not operational, a state or federal pilot aboard, with the 0400 to 0800 watch on duty. Again, typically, equipment failure w s not involved in cause.

Marine collision investigations and collision studies resulted in 222 Safety Board recommendations during the 1970-79 period, 190 of them to the Coast Guard. The Coast Guard has begun or completed action that is acceptable to the Board in 65 percent of those recommendations, the Board said. U.S. regulations incorporating the latest international safety agreements "will resolve the majority of the Safety Board's current recommendations to improve steering reliability" when the regulations take effect in 1984.

The Safety Board recommended that the Coast Guard speed its study of required automatic navigation data recorders and that the U.S. Maritime Administration work with the Coast Guard on possible use of simulators in teaching emergency shiphandling procedures to cope with control system failures.

The Safety Board's complete printed special study entitled "Major Marine Collisions and Effects of Preventive Recommendations" is available free by writing to the Publications Branch, National Transportation Safety Board, Washington, D.C. 20594. Multiple copies may be obtained by mail from the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

SAILBOAT RESCUES BY THE AMVER FLEET

Two men aboard a dismasted sailboat were assisted by an AMVER participant last June. A distress alarm from the TRIPLE JACK was picked up by the Canadian Coast Guard in Falmouth, Nova Scotia. The 45-ft trimaran's last known position was 42°15'N, 60°30'W. A U.S. Coast Guard C-130 aircraft from Elizabeth City, N.C., was sent to the scene. The plane located the disabled sailboat and established communications. The C-130 then spotted the TELINDA and asked it to divert to the scene. The TELINDA did so, took both crewmen and their sailboat aboard and proceeded to Bridgeport, Conn.

Three crewmen aboard another sailboat were picked up by an AMVER participant on June 30 after their 31-ft craft sank in heavy weather. The MADIL was 210 mi east of Cape Henry, Va., when the crew broadcast a message on VHF Channel 16 saying that the boat was going down. The message was passed to the U.S. Coast Guard by the SAROULA.

A C-130 aircraft and H-3 helicopter from Elizabeth, City, N.C., were dispatched. Two pumps were dropped to the MADIL but could not be retrieved in the 20-ft seas and 40-kn winds. The C-130 asked the SALVATORE DAMICO to divert.

As darkness fell the three men aboard the MADIL abandoned into a liferaft and the sailboat sank. Neither helicopter hoist nor ship pick-up were considered safe, and a second attempt was planned for the first light. The SALVATORE DAMICO stood by throughout the night and was able to remove the three men the following morning. All three were in good condition. They went to Norfolk aboard the SALVATORE DAMICO.

Ten crewmen from an Italian sailboat were rescued by an AMVER award winner on July 8. The 67-ft SERENISSMA was participating in a transatlantic race when it began taking on water at the Grand Banks of Newfoundland. The vessel broadcast a distress call that was relayed to the Canadian Rescue Coordination Center in Halifax, Nova Scotia. Canadian aircraft were dispatched to search for the sailboat. Although the seas were calm, visibility was less than 1 mi in heavy fog.

In response to a broadcast from the Canadian RCC the DORA OLDENDORFF, winner of an AMVER award this year, headed for the scene. Meanwhile, aircraft homed in on the sailboat's ELT signal and located the two liferafts in position 44-26.05N, 47-40.58W. Halifax advised the merchant vessel of the precise location of the rafts. The ship went to the scene and launched a small boat. All 10 crewmen from the sailboat were picked up in good condition. The DORA OLDENDORFF proceeded to Ghent, Belgium.

The VALHALLA was bound for New York from St. Thomas, Virgin Islands, after a stop in Bermuda when it lost its rigging and sails on August 20. On the 22d a passing AMVER participant, the VOLENDAM, gave fuel to the 32-ft cutter for the voyage to New York. The yacht's engine broke down later that day, however, and the boat drifted for 2 days until the WINTER WAVE, another AMVER participant, spotted the craft and picked up the four crewmembers. The VALHALLA was left adrift at 35°40'N, 66°32'W.

MARINE WEATHER REVIEW

The Smooth Log (complete with cyclone tracks, climatological data from U.S. Ocean Buoys, and gale and wave tables) is a definitive report on average monthly weather systems, the primary storms which affected marine areas, and late-reported ship casualties for 2 mo. The Rough Log is a preliminary account of the weather for 2 more recent months, prepared as soon as the necessary meteorological analyses and other data become available. For both Smooth and Rough Logs, storms are discussed during the month in which they first developed. Unless stated otherwise, all winds are sustained winds and not wind gusts.

Smooth Log, North Atlantic Weather

May and June 1981

SMOOTH LOG, MAY 1981--This was more like a summer than a spring month. The ocean was relatively quiet, except off the east coast of the United States and the vicinity of the British Isles. There was no primary storm track over the major shipping lanes, but there was one over the Great Lakes-St. Lawrence River system extending to Kap Farvel. Two storms moved across the East Coast, and several more formed some distance off the coast. One storm tracked from Quebec to the Baltic Sea and another formed northeast of Bermuda and made it to Ireland. There was a series of cyclones that circled over and west of the United Kingdom during the last half of the month. There was one storm that affected the northern Mediterranean the first week.

The mean sea-level pressure chart reflected cyclone tracks. What would have been the Icelandic Low was the 1004-mb Irish Low near Donegal Bay. There was also a small 1012-mb LOW center near Hoare Bay in Baffin Island and a 1013-mb depression over northern Vermont. The most prominent feature was the 1026-mb Azores High centered near 34°N, 42°W. It differed from climatology with a ridge extending northward along longitude 45°W to latitude 55°N (fig. 9).

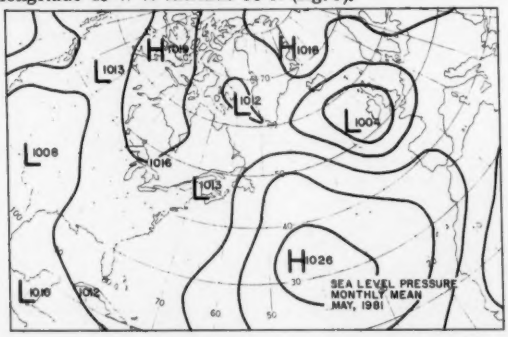


Figure 9.--Mean sea-level pressure, May 1981.

The deepest and largest anomaly was minus 11 mb near Fastnet Rock. The ridge extending toward Kap Farvel resulted in a plus 7-mb anomaly center about 500 mi east of Cape Race. There was a large flat area of up to minus 3 mb over the southeastern United States to 60°W, between 30° and 40°N.

The upper air had an anomalous pronounced ridge over midocean along approximately 40°W. There were long-wave troughs along 65° and 10°W.

The tropical cyclone season got off to an early start this month with Arlene.

Extratropical Cyclones--This was the only storm this month that tracked from continent to continent. It moved off the Labrador coast early on the 1st. The E.E. PRINCE was in the Strait of Belle Isle at 1200 with 45-kn winds blowing up the Strait. The storm passed over Kap Farvel at 0000 on the 2d. Late that day the FRITHJOF was in the Denmark Strait with 44-kn northerly winds and 18-ft waves. By 1200 on the 3d the 990-mb storm was near 59°N, 11°W. Several ships off Ireland and in the southern North Sea had about 40 kn. The JACK WHARTON, south of Fastnet Rock, had 47 kn with 21-ft waves. Lima measured 35 kn with 20-ft seas. At midday on the 4th the storm was over the North Sea but causing no harm.

This LOW formed in the area of primary cyclogenesis off the U.S. East Coast, but it didn't go anywhere. It was first analyzed on the 1200 chart of the 2d as a frontal wave. Frontal waves had been moving northeastward along a quasi-stationary front off the U.S. East Coast for several days. On the 3d the CG26 (44°N, 64°W) found 45-kn north-northeasterly winds. At 1800 the NOVA GORICA (38°N, 59°W) had southeasterly 52-kn winds with 15-ft waves. The ESSO NASSAU (36°N, 72°W) had 50-kn winds with 23-ft waves at 2300. The LOW was moving southwesterly, the opposite of the usual direction. At 0000 on the 4th buoy 41001 measured 23-ft seas. The Atlantic COGNAC (39°N, 71°W) reported 52-kn winds from 030° with 26-ft seas. At 1200 the LAERTES (38°N, 71°W) reported the winds as 45 kn from 020° with 20-ft seas and 26-ft swells. The SOCONY VACUUM near 34°N, 76°W, had 41-ft swell waves out of the north. By 0000 on the 5th the storm was turning northward at 998 mb near 32°N, 66°W. The NORDIC LOUISIANA (30°N, 66°W) had 42-kn gales. The storm was only a weak trough on the 7th.

Monster of the Month--This storm's claim to fame was mostly some high-wave reports. It formed in a sharp frontal trough west of the Bay of Biscay on the 7th. There had been persistent northerly flow from an older system for many hours. At 1200 the LAURA PANDO reported 38-ft swell waves near 40°N, 23°W. At 1800 the AMERICAN LEGEND at 50°N, 12°W, had 43-kn northerly winds but only 15-ft waves.

The cyclone initially moved northward, but on the 8th it curved westward, then southward, and finally northward again on the 10th. On the 8th the MONT JOLY (50°N, 19°W) had northerly 50-kn winds with 26-ft seas.

The winds west of longitude 15°W had been northerly for some time, and at 1800 on the 8th the GEESTSTAR (47°N, 19°W) reported northerly 44-kn winds, 33-ft seas, and 46-ft swells. At 0000 and 1200 on the 9th OWS Romeo measured the seas at 33 ft. At 0600 the GEESTSTAR was still sailing into 25-ft seas and 41-ft swells. Other ships had winds in the 40-kn range and waves between 20 and 30 ft.

By 1200 on the 10th the storm was near Brest at 990 mb. Romeo now had 20-ft seas and a ship off Lisbon had 25-ft waves. By the 11th another center had formed over Germany and rapidly sapped the strength of this storm.

A frontal wave formed over the St. Lawrence River Valley on the 9th. It traveled northeastward and was south of Kap Farvel at 1800 on the 11th. It was 994 mb at 0000 on the 12th. A ship at 56°N, 39°W, reported 41-kn winds with 21-ft seas. Fishing vessels near Iceland were finding gales with seas up to 20 ft south of the island, but on the 13th the ARNI FRIDRIKSSON off the northwest coast reported 50- to 60-kn winds from the northeast several times. No waves were included.

On the 14th a trough was rotating through the southern circulation, and by 1200 a 988-mb LOW had formed to become the primary storm near 51°N, 19°W. The DART CANADA (49°N, 15°W) had 47-kn winds and the AMERICAN ARCHER (50°N, 28°W) had 25-ft waves. OWS Romeo had 26-ft seas on the 15th that continued into the 16th. The GEESTSTAR reported 52-kn westerly winds with 33-ft seas at 0600, while Romeo reported 30 ft. The upper air LOW was quasi-stationary near 50°N, 15°W, and the surface LOW was moving slowly counterclockwise around it. On the 17th another LOW was moving around the southern part of the circulation. This weakened the storm, and it slowly deteriorated.

This was a long-lived cyclone. It originated as a heat low over the western Great Basin on the 14th. It moved slowly eastward across the sun belt and crossed the east coast south of Cape Hatteras on the 21st. It started expanding as it moved over the Gulf Stream. There were a few gales on the 22d. The CGC EAGLE south of Cape Cod found 40-kn winds. The OGDEN CHAMPION (34°N, 74°W) contended with 50-kn winds. A double center developed on the 23d and persisted until the 25th, while there were gale reports. At 1200 on the 25th the 996-mb storm was near 46°N, 55°W. On the 26th there were several vessels southeast of Cape Race that reported winds over 40 kn and waves near 20 ft.

The storm stalled near 52°N, 28°W, on the 27th. By the 29th another center had formed, which moved northward to dissipate. During this time Charlie was measuring gales with waves near 20 ft. A German ship near 53°N, 34°W, quoted 48-kn winds with 20-ft seas. The AMERICAN LEADER (53°N, 33°W) found 40 kn and 23-ft waves.

Tropical Cyclones--Tropical Storm Arlene was spawned from a disturbance that had moved eastward through the Caribbean for several days. Early on the 7th it was classified as a tropical depression. A short time later tropical storm Arlene was born about 25 mi south of Cayman Brae in the Cayman Islands. Moving northeastward at about 10 kn, Arlene's winds climbed to an estimated 40 kn, with stronger gusts, before she moved across eastern Cuba early on the 8th. She crossed the coast about 60 mi south of Camaguey and left it about 60 mi east-northeast of Camaguey. Arlene dumped heavy rains over eastern Cuba and was now spreading them into the central and southeastern Bahamas. She weakened slightly, but regained tropical storm strength once over the warm tropical waters. On the 9th Arlene moved out into the open Atlantic and her remnants were absorbed by a nontropical low.

Casualties--May 6 was a bad day with fog, and there were two collisions. The Staten Island ferry AMERICAN LEGION and the HOEGH ORCHID collided in New York Harbor (fig. 10). The HELLENIC CARRIER and the LASH ATLANTICO collided off Cape Henry, Va.

The fishing vessel DAY DAWN was hit by a large wave while approaching Shetland Island; she took a heavy list and sank. The Greek NAGOS encountered heavy weather 450 mi north of the Azores on the 6th and water leaked into No. 1 hold. On the 9th the British DOLPHIN POINT and the ARPOADOR collided in patchy fog off Gravesend. Fog was also involved in the collision of the DOURO and TOJARO off Spurn Head on the 13th. There was fog in the same area on the 20th, when the OCEAN CONTENDER and the REBECCA ELYSE collided. The Brazilian LLOYDBRAS had damage to deck cargo off the northeast coast of Brazil. The MARLHILL sank, on the 30th, 145 mi east-southeast of Cape Charles after heavy-weather damage while under tow of the tug IRVING BIRCH. Two days later on June 1 the LAC DES ILES sank while under tow of the same tug.

Figure 10.--The fog had lifted but it was still somewhat hazy when this photograph showing the slash in the side of the AMERICAN LEGION was taken. U.S. Coast Guard Photo.

SMOOTH LOG, JUNE 1981--The tracks of this month's major cyclones did not match climatology very well. In fact, there was no favorite path. The majority of the cyclone centers were north of 35°N and west of 30°W. Early in the month a storm tracked from off New York to across Scandinavia. Several storms tracked from the Gulf of St. Lawrence toward southern Greenland. During the first 2 weeks of the month, several storms paralleled latitude 40°N from south of Nova Scotia to midocean. There were only three significant cyclones in the area between longitude 30°W and the European coast, and all were in the first week. Two affected the Mediterranean.

The mean sea-level pressure chart was very different from climatology. The only part of the pattern that was comparable was the central pressure of the Azores High (1023 mb) near 30°N, 30°W, and westward to the coast of the United States. The Icelandic Low did not exist. There were two 1009- and 1010-mb Low centers in the area from Scandinavia to Spitsbergen. There were also 1008-mb Low centers over Quebec Province and eastern Hudson Bay. The Azores High had a neck (ridge) that extended northeastward to the Brest Peninsula (fig. 11).

There were no major anomaly centers, but many small ones. There were negative anomalies over Scandinavia to Spitsbergen and from Canada to northwest of the Azores. The area from the North Pole to Greenland to France was positive.

The upper air at 700 mb was different from the normal pattern. The primary Low was shifted southward to Mansel Island in Hudson Bay, and the long-wave trough extended southeastward along the Labrador coast to midocean. There was a short-wave trough to the south from Nova Scotia. A ridge paralleled longitude 20°W with another displaced Low over Spitsbergen with a trough paralleling longitude 10°E. The usual short-wave trough was off the Portuguese and Moroccan coasts.

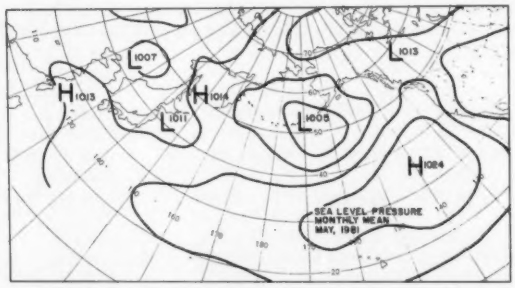


Figure 11.--Mean sea-level pressure, June 1981.

Tropical storm Brett formed the last day of the month.

Extratropical Cyclones--This cyclone was on the charts off Portugal on the first chart of the month. It traveled northward along longitude 13°W. By 1200 on

the 2d it was 994 mb near 52°N, 13°W. Several ships had gales south of the center. The STRATHEDEN (36°N, 11°W) reported 50-kn winds. Another ship near 48°N, 15°W, had 52-kn winds with 13-ft waves, while another near 49°N, 12°W, had 18-ft seas. The storm was shrinking on the 3d and disappeared on the 4th.

This LOW was over the Strait of Belle Isle on the 1st. By late on the 2d ships east of Cape Race found 40-kn winds. A German ship (51°N, 46°W) had 39-kn and 13-ft waves. On the 3d the 988-mb storm was near 54°N, 34°W. A Soviet ship near 52°N, 44°W, had 48-kn winds at 1200. The ATLANTIC CAUSEWAY (48°N, 34°W) had 40-kn winds with 20-ft waves.

At 0000 on the 4th OWS CHARLIE had 18-ft swell waves. The LOW was either retrogressing or making a loop at this time. The Soviet ship ESRF reported 48-kn westerly winds near 51°N, 43°W, with 20-ft seas and was indicated in the wind-wave analysis. A Danish ship was at 59°N, 43°W, at 0600 with 44-kn winds and 26-ft waves. There were several gale reports south of the center at 1200. The storm was weakening on the 5th, but the JEFFERSON (48°N, 30°W) had 16-ft seas and 26-ft swells with gales. The cyclone could no longer be found after the first chart on the 6th.

While this was a long-lived cyclone, it did not last long after it reached the Atlantic. It can be traced from the Bering Sea on the 1st. It traveled southeastward across Canada and was over Anticosti Island on the 7th. There was a gale report near the front off Norfolk. There were gales in the southeasterly flow on the 8th with the SEDCO reaching 44 kn.

The front was swinging far out of the LOW, which had slowed, on the 9th. Late in the day another center formed to the east, and by late on the 10th this circulation did not have a center.

Monster of the Month--This circulation formed on an occluded front over the St. Lawrence Basin on the 9th. The previous LOW was dissipating, and this one developed rapidly in its wake. The SCOTTISH LION near 38°N, 67°W, had winds between 30 and 45 kn and 20-ft waves. The speed barbs were obscured by other parts of the plot. Canadian ships to the north had 35- to 40-kn winds. The CJR6 (44°N, 60°W) reported 45-kn winds with 15-ft waves. The 980-mb storm was over Cape Race at 0000 on the 11th. The RODRIGUES CABRILHO (40°N, 53°W) and the AMERICAN ALLIANCE (51°N, 34°W) both had 35-kn gales and 20-ft waves that day.

By 1200 on the 12th this 972-mb storm was near 51°N, 37°W. Its cyclonic circulation extended from Newfoundland to Ireland and 30°N to 65°N. Lima measured 48-kn east-southeasterly winds raising 20-ft seas with 23-ft swells. The OGDEN THAMES (48°N, 36°W) was sailing southwestward into 43-kn winds with 25-ft seas and swells. Most ships with high winds were reporting gales. On the 13th the SUDURLAND (63°N, 21°W) had 52-kn easterly winds. The Soviet URYD (53°N, 27°W) found 43-kn southwesterly winds with 23-ft seas. Charlie had winds near 40 kn and seas over 20 ft on the 14th. The storm was rapidly losing strength as high pressure built to the south. On the 0000 chart of the 15th another LOW was found 600 mi to the east. Twelve hours later the new cyclone had taken over.

The remainder of the month the storms were kept well to the west as high pressure moved northward and eastward.

This storm formed over Alberta, Canada on the 16th. It moved eastward and deepened rapidly. At 1200 on the 18th it was 980 mb about 250 mi northeast of Winnipeg. About 1800 the front was crossing Lake Superior. The PAUL H. CARNAHAN was near the center of the lake (47.6°N, 88°W) and measured 52-kn westerly winds. The waves were 6.5 ft. Nearby the GEORGE M. HUMPHREY (47.7°N, 88.7°W) measured 36-kn winds from the west-southwest and 6.5-ft waves. At 0000 on the 19th the storm was 988 mb near 55°N, 85°W, on the southern shore of Hudson Bay. The front was now slightly east of Sault Ste. Marie. The BENJAMIN F. FAIRLESS had arrived in the same general area of the previous observations and found 37-kn westerly winds with 5-ft waves. No winds of 35 kn or higher were reported on the other lakes as the storm turned northeastward. It continued to Hudson Strait where it dissipated.

The path of this LOW was directly affected by high pressure west of the English Channel. The cyclone formed over the Mississippi Valley late on the 21st. By the 23d its southerly circulation was off the east coast and a ship near 36°N, 70°W, found 28-ft swells out of the southwest. The SEDCO recorded gales. The storm was traveling down the St. Lawrence River Valley and at 0000 on the 24th was 988 mb north of Sept-Iles. At this time there was a 1032-mb HIGH centered about 600 mi west of Ireland, a 1025-mb cell over Iceland, and a 1028-mb cell about 600 mi southeast of Cape Race. The OCEA at 48°N, 50°W, reported winds of 44 kn. Later in the day a SHIP (49°N, 43°W) found southerly 48-kn winds near the warm front. The LOW crossed the Labrador Sea and crashed against the southwest coast of Greenland and disintegrated. The AMERICAN LEADER was between the front and the HIGH with 21-ft swells.

The HIGH persisted west of Ireland and on the 25th a front developed over western Europe. Frontal waves formed on the front on the 26th and traveled northeastward. As they moved over the Low Countries and Scandinavia, the gradient was increased over the North Sea causing gales and high waves for the many ships and rigs--the highest being about 45 kn and 20 ft. On the 27th the gradient relaxed as the front drifted eastward.

Tropical Cyclones--On the 29th a low-pressure system developed about 150 mi east of Cape Hatteras. This was the beginning of tropical storm Brett. On the 30th a reconnaissance aircraft found the second tropical storm of the season some 120 mi east-northeast of Cape Hatteras. Brett was moving west-northwestward at about 12 kn. Highest sustained winds were about 50 kn in squalls near the 997-mb center. Gales extended outward 100 mi. By midnight on the 1st Brett was about 40 mi east of Norfolk. Several hours later a rapidly weakening storm moved inland across the Virginia coast and southern Chesapeake Bay. Two pleasure boats, the 43-ft yacht PATRIOT and the 40-ft VALIANT LADY, were caught in the storm and the subject of a search by the Coast Guard.

Casualties--Fog was the biggest culprit this month. The first day of the month the MAJORCA struck a rock while approaching St.-Malo in fog. The STELLA SCARLETT ran aground in fog on the 2d at Malmo port entrance. The 999-ton SLOMAN RANGER and the 10,673-ton ARTEMIS ISLAND collided in fog 100 mi off Cartagena on the 12th. The SLOMAN RANGER capsized with four crewmen missing. On the 13th the 38,826-ton TITAN and the 5,069-ton TALAVERA collided in fog in the English Channel. The same day the ferry LION made contact with the Eastern Arm at Dover in fog.

The morning of the 16th the 15,644-ton GOOD CAPTAIN and the 13,074-ton CHARITY collided in fog south of Sicily. The CHARITY sank with all rescued.

On the 14th the wooden motor fishing vessel SERIOUS BUSINESS hit a reef off southern Jamaica and caught fire. The crew spent the night in a liferaft in heavy seas and thunderstorms.

The KAPETAN ANDREAS grounded at Great Inagua Island in poor visibility on the 16th. The KAPTAI contacted the lockwall at Beauharnois Lock in squally weather on the 26th.

Other Casualties--The ANGELINA was reported as having sunk off Montevideo as a result of heavy-weather damage. The ALMIRANTE STORNI contacted the TWIN SAPPHIRE while berthing in strong winds in Montevideo. The SEA ROVER was at Cape Town repairing heavy-weather damage sustained in June.

Smooth Log, North Pacific Weather

May and June 1981

SMOOTH LOG, MAY 1981--This was a pacific month. There were fewer storms than usual. If there was a primary storm path, it extended from Hokkaido to south of Unimak Island. The more severe storms were during the latter part of the month. Two cyclones occurring at the same time in the first week of the month had odd paths. One started off northern Honshu and tracked southeastward for 10 days, ending near 19°N, 175°W. This cyclone was associated with a cutoff upper level LOW. The other started over the northern Sea of Okhotsk and traveled to the Bering Strait, where it turned southeastward, ending south of the Alaska Peninsula near 47°N, 160°W. This was the result of high pressure off the British Columbia coast at the surface, and high pressure building northwestward into Alaska from Canada in the upper air.

The mean sea-level pressure pattern reflected a 1005-mb Aleutian LOW near 50°N, 163°W. The Pacific High was 1024 mb centered near 33°N, 138°W (fig. 12).

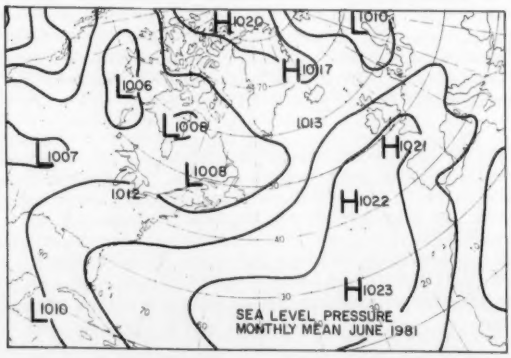


Figure 12.--Mean sea-level pressure, May 1981.

The most significant departure from normal was the location and shape of the Aleutian Low. Normally, it is more like an east-west trough along latitude 53°N with multicenters. The primary anomaly of minus 9 mb near 48°N, 163°W, was associated with this LOW.

The upper air flow was primarily zonal between 30° and 50°N. The Aleutian Low was supported by a low center near 51°N, 166°W, in a narrow trough from a deep LOW over the Laptev Sea. A sharp ridge extended westward from Canada into Alaska.

Tropical storm Adrian became the first tropical cyclone in the eastern Pacific this year.

Extratropical Cyclones--The first significant storm came out of the East China Sea on the 6th as a frontal wave. The cyclone intensified rapidly on the 8th after crossing Japan. There were several strong gale reports. The PACMONARCH (44°N, 154°E) found 50-kn easterly winds north of the center on the 9th. The ANDRES MAERSK nearby had 20-ft waves. There were a few gale reports on the 10th and 11th as a second LOW developed behind (west of) this one. On the 12th this LOW dissipated and the western LOW continued to develop. This second LOW turned northeastward on the 14th and tracked into the Gulf of Alaska on the 16th. The winds were mostly light, but the LESLIE LYKES and SINCERE No. 5 found 23- and 27-ft swells near 45°N, 150°W, on the 16th and 17th, respectively. The center had disappeared by the 18th.

The La Perouse Strait was the birthplace of this cyclone. The storm was east of the Kuriles on the 16th, and a Soviet ship (53°N, 161°E) found 50-kn northeasterly winds. The storm had organized a fairly large circulation, but it was only 990 mb at 0000 on the 18th. The MULHEIM (41°N, 172°W) had 39-kn winds out of the south, but there were 26-ft swell waves from the north-

west according to the report. On the 19th the storm was 970 mb over Unimak Island. The QUEENS WAY BRIDGE (50°N, 159°W) had 45-kn winds, and the PRESIDENT MADISON (51°N, 163°W) had 40 kn. The PRESIDENT TRUMAN (54°N, 170°W) had 50-kn winds with 28-ft swells on the 20th. The storm was 966 mb over the Bering Sea. It started weakening and its area of influence decreased rapidly as another storm to the south moved eastward.

The 0000 chart of the 23d indicated a frontal wave near 44°N, 155°E, thanks to ship observations. By the 25th it had developed into a 988-mb storm with the TOYOTA MARU measuring 989 mb. Two ships south of the center reported 40-kn winds. A thousand miles to the east the EASTERN FORTUNE called the swell waves 33 ft. At 0600 the PRESIDENT TYLER was 800 mi south of the center with 55-kn winds from the northwest, 33-ft seas, and 46-ft swells.

The SEIYO MARU (39°N, 177°W) came in with 40-kn winds and 26-ft waves on the 26th. Twelve hours later the NEW GOLDEN PHOENIX (35°N, 175°W) had 55-kn winds with 16-ft seas. The storm turned southeastward, then eastward, and finally northeastward. The higher wind reports were gales with isolated reports of waves up to 23 ft. The storm was deteriorating on the 28th, but it took one last 52-kn swipe at the MOBIL MERIDIAN at the occlusion off Vancouver Island.

This storm was almost of tropical origin as the wave formed on a front over the southern point of Taiwan. It traveled northeastward along the southern and eastern coast of Japan. It was near Tokyo on the 24th. The DALNIY VOSTOK had sailed westward through the center and found 58-kn northerly winds on the west side. On the 25th there were quite a few gale reports with the LAKE ARROWHEAD (40°N, 150°E) finding 45 kn. Close by the BERKSHIRE had 20-ft waves, and near 43°N, 154°E, a ship had 26-ft swells. Gales continued. At 1200 on the 27th the 990 mb LOW was near 47°N, 164°E. A Soviet ship at 41°N, 152°E, had 50-kn winds. On the 29th a second center formed and yet a third on the 30th. The storm was dying.

This storm came out of Asia on the 27th. It brought rain to Korea and Japan for spring gardens. As it moved into the warmer Pacific it deepened and spread rapidly. The SAMUEL S. measured 50-kn southeasterly winds near 40°N, 150°E, and the OCEAN LOG at 32°N, 146°E, had southwesterly 62-kn winds on the 29th. The highest waves appeared to be about 25 ft. On the 30th the THOMAS WASHINGTON (44°N, 160°E) was near and east of the occlusion with 45-kn winds and 30-ft swells.

On June 1 the storm was 982 mb near 49°N, 175°E, and another circulation had formed at the point of occlusion. It became the primary center on the 2d. The winds were still gale force or less with a few swell reports over 20 ft. The second LOW went ashore on the 5th.

Tropical Cyclones, Eastern North Pacific--Tropical storm Adrian became the seventh May storm since 1966 to begin the eastern North Pacific season. He started life on the 30th, some 470 mi southwest of Acapulco. Adrian took a path toward the east-northeast. He became a tropical storm on the 31st. Maximum winds reached 40 kn for a short time on the 1st, but by the following day Adrian had fallen to tropical-depression strength. By the 4th he dissipated about 120 mi east-southeast of Acapulco.

Casualties--The MAYA requested a heavy-weather damage survey on the 13th at Kobe. The ASTIR requested an ice damage survey on the 18th on arrival at Aioi. The JAPAN CANELA arrived San Francisco with damage due to cargo shifting in heavy weather.

Other Casualties--The 18,400-ton PACIFIC CHARGER on her maiden voyage ran aground in heavy seas off New Zealand. Heavy thunderstorms hit the United Arab Emirates and Oman the first of the month. Several ships broke their moorings in winds up to 70 kn. In Oman 33 people were killed, and 3,000 were affected by winds and floods. Ten were killed in Abu Dhabi.

SMOOTH LOG, JUNE 1981--This was a quiet month with no especially severe extratropical cyclones. There were fewer cyclones than normal this month, except over the Gulf of Alaska. There were two lightly traveled tracks over the western ocean, one from off northern Honshu eastward to the vicinity of longitude 170°E and the other from about 600 mi southeast of Tokyo eastward to midocean and then northeastward into the Gulf of Alaska. Contributing to the cyclones over the Gulf of Alaska were some that formed in the area or came out of the Bering Sea.

The major sea-level pressure feature was the 1025-mb Pacific High, which was normally located near 35°N, 140°W. The usual ridge into the Seattle area was slightly stronger than normal. The 1010-mb Aleutian Low was found over the Gulf of Alaska south of the Semidi Islands rather than north of Adak Island. There were two anomalous 1017-mb high-pressure centers in the northern latitudes, one near Agattu Island in the Aleutians and the other near Ostrov Paramushir in the Kurile Islands (fig. 13).

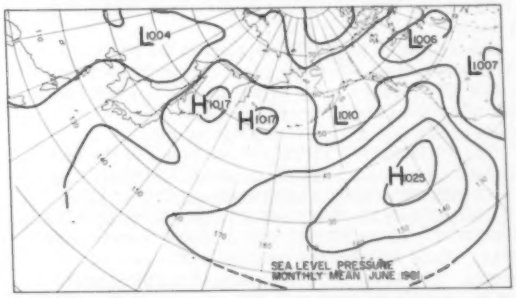


Figure 13.--Mean sea-level pressure, June 1981.

The two anomalous high-pressure centers both produced plus 5-mb anomaly centers. The Aleutian Low over the Gulf of Alaska resulted in a minus 4-mb anomaly center near 50°N, 140°W.

The upper air pattern at 700 mb was displaced in much the same way as the surface. The LOW was

south of the Alaska Peninsula rather than north of Adak Island. There was a high center over Kamchatka and a small cut-off HIGH in the ridge over southeastern Alaska. The zonal flow was primarily between latitudes 30° and 40°N over the western ocean and between latitudes 35° and 50°N over the eastern ocean.

There were four tropical cyclones over the North Pacific, tropical storm Ike and typhoons June and Kelly over the western ocean and hurricane Beatriz over the eastern ocean.

Extratropical Cyclones--This LOW formed in a col over the Sea of Japan between two high-pressure systems and north of a frontal wave. By 0000 on the 3d the cyclone was over the Kuroshio Current and deepening. The FRANCIS SINCERE was almost in the center of the storm (41°N, 151°E) with 36-kn gales from the east and 25-ft waves. At 1200 the CLOVER was south of the center with gales and 20-ft waves. The storm was traveling slightly north of east with light winds.

On the 8th the storm was approaching the Washington coast. The ARCO JUNEAU was near Cape Blanco with 35-kn gales. On the 9th the storm no longer existed.

On the 12th the Pacific High was moving toward the California coast causing an increased gradient along the coast. Several ships found gales to strong gales. The WALTER RICE (36°N, 123°W) found 40-kn northwesterly winds with 23-ft waves. On the 14th the NWPB had 44 kn. A few miles away a Soviet ship had 20-ft waves. The gradient relaxed on the 16th.

On the 11th a front that roughly paralleled latitude 30°N stretched from China to the United States. A weak wave was analyzed south of Japan at the time. On the 13th the storm was east of Hokkaido. The CANADIAN HIGHWAY (38°N, 155°E) found 38-kn winds. The storm was 988 mb near 45°N, 162°E, by 0000 on the 14th. The YOUNG SPLENDOUR and the H9NG, both near 42°N, 171°E, had 45-kn winds with the waves reaching 12 ft. At 1800 a ship near 46°N, 175°E, east of the occlusion had 40-kn winds and 20-ft seas.

On the 15th a new LOW formed at the point of occlusion and sped off to the east. A Japanese ship reported 20-ft waves south of the LOW. A Panamanian ship near the Date Line and 38°N had 45-kn winds, while another ship reported 23-ft waves.

The PRESIDENT TRUMAN was north of the new cyclone on the 16th with 45-kn winds and 25-ft waves. The winds were 50 kn and the waves 26 ft at 1200. The swell was 33 ft at 1800. The NEW GOLDEN PHOENIX was north of the original storm with 48 kn. Late that day the original LOW was only a trough. The second LOW continued northeastward and at 0000 on the 18th was 990 mb near 50°N, 160°W. There were several reports of gales and waves near 15 ft. Another low-pressure center had formed off Vancouver Island and was moving onto the coast ahead of this storm. The MOBIL ARCTIC was off Cape St. James and measured 55-kn easterly winds. Both LOWs had dissipated by the 20th.

Again there were strong northerly winds off the California coast between the Pacific High and a heat LOW near Las Vegas starting on the 18th. The NDAD was off San Francisco with 54-kn winds from 340°; no waves were reported. Gale winds were still being found on the 21st, when the AUSTRAL ENDURANCE at 37°N, 125°W, found 25-ft swell waves.

This LOW suddenly popped up over the Sea of Japan late on the 17th. There were a few gales on the 18th. The PACBARONESS at 36°N, 145°E, had 39-kn winds from the north and 16-ft waves on the 19th. At 0600 the NEPTUNE DIAMOND north of the storm center had 36-kn easterlies with 20-ft swells. At 1800 a Liberian ship had 35-kn gales, 20-ft seas, and 25-ft swells.

Late on the 20th the storm suddenly turned northwestward. At 0000 on the 21st it was 996 mb near 39°N, 157°E. A ship slightly north of the warm front reported 30-ft swells. The storm was weakening and it disappeared on the 22d.

The remainder of the month there were only weak cyclones. The primary feature was the Pacific High at about 1035 mb. The gradient between the HIGH and the heat LOW again tightened. On the 26th and 27th the DAVID STARR JORDON, PRESIDENT TRUMAN, and the USCGC YACONA had 38- to 50-kn northerly winds off northern California. On the 28th a Soviet ship (41°N, 125°W) had 52-kn winds. A United States ship (40°N, 125°W) found 40 kn and 20-ft waves. The gradient relaxed on the 29th as the Pacific High drifted westward.

Tropical Cyclones, Western North Pacific--Ike was spawned by a low-pressure area that had moved westward across the South China Sea on the 8th. He became a tropical depression the following day some 60 mi north of the Paracel Islands. Ike was christened later that evening as winds reached tropical storm strength south of Hainan. On the 10th while still lacking organization, sustained winds of 40 kn with gusts to 60 kn were recorded at Sanhu Island about 60 mi from the center. Ike slowed and turned northeastward during the day. By the 12th his circulation had expanded to cover 500 mi, and he was moving east-northeastward at 13 kn. Early that same day the LUISE LEONHARDT encountered 45-kn winds 60 mi east-southeast of Ike's center; a short time later reconnaissance aircraft reported a 967-mb center at sea level. On the 13th the PRESIDENT MADISON enroute to Kaohsiung from Guam encountered 33-ft seas, 50-kn winds, and a 981.6-mb pressure some 35 mi from the center. The ship's barogram indicates the pressure dropped another 6 mb as she headed for port. Ike crossed southern Taiwan near Kaohsiung and moved northeastward across the island causing severe flooding and killing five people. Late on the 13th a secondary center formed off the northern tip of Taiwan. The primary center dissipated off the east coast on the 14th, while the secondary center moved northeastward and dissipated the following day.

Ike was responsible for several marine mishaps in addition to a missing aircraft believed to have crashed on a cliff along the east coast of Taiwan. The RISING DRAGON was driven aground 100 mi north-northwest of Kaohsiung. The salvage tug SALVISCOUNT rescued 21 men from the stricken cargo ship. The ESSO SCOTIA broke her moorings from a scrapyard and

sank a fishing vessel before colliding with the PROSPERITY. The bulkcarrier NIKEA reported hull and cargo damage due to the storm.

Typhoon June developed on the 17th about 480 mi east of central Luzon. As a tropical storm, she moved toward the northwest and intensified. By late on the 18th, just west of the Luzon Strait, June reached typhoon intensity. The following day she turned northward through a break in the subtropical ridge. Taiwan received its second beating in a week when June, sporting 80-kn winds, moved across the east coast on the 20th. Once north of Taiwan June weakened to tropical storm strength and recurved toward the northeast on the 21st. The following day she petered out just before reaching Kyushu.

Kelly originated as a tropical depression some 280 mi northwest of Yap Island on the 28th. He intensified to tropical storm strength late on the 30th just before crossing the Philippines near Catanduanes. Thunderstorms and torrential downpours resulted in severe flooding and landslides. About 200 Philippinos were killed, mostly residents near the Mayon Volcano. Steady rain loosened volcanic debris on the slopes causing an avalanche that destroyed nearly 600 homes. The BISMARCK SEA suffered an engine breakdown in the South China Sea on the 30th and because of the storm had to be towed to Manila.

Kelly entered the South China Sea on the 1st, moving westward at 10 kn; at this time he was a tropical depression. However, later in the day he regained tropical storm status, and by early on the 3d was at typhoon strength. Kelly was now moving toward the west-northwest. On the morning of the 3d the typhoon passed the Paracel Islands between Xisha Dao and Sanhu Dao. Sustained winds of 76 kn with gusts reaching 80 kn and a minimum sea-level pressure of 970.8 mb were recorded at Xisha Dao. The typhoon reached peak intensity that afternoon when surface winds were estimated at 80 kn around a 950-mb pressure center. The SAM EUN sank 22 mi east of Waglan Island just before dawn on the 4th as she headed for Hong Kong. Three American warships, the KIRK, TOWERS, and MIDWAY, rescued 19 survivors, while the KWANG TA rescued 7. About this time Kelly was crossing the southwest coast of Hainan. He landed on the Vietnam coast about 10 mi south of Hanoi on the 5th as a tropical depression.

Tropical Cyclones, Eastern North Pacific--Hurricane Beatriz came to life on the 28th some 360 mi southwest of Acapulco. Moving west-northwestward, then northwestward, Beatriz reached tropical storm intensity on the 29th and hurricane strength the following day as she approached the 15th parallel near 111°W. On the 1st maximum winds were estimated at 75 kn with gales extending out 140 mi from her center, which was passing about 180 mi southwest of Socorro Island. As Beatriz crossed the 20th parallel, near 123°W, she dropped back to tropical storm strength. The following day she dissipated.

Casualties--The 83,102-ton American LNG AQUARIUS sustained heavy-weather damage on the 19th to 20th. The AEGIS IONIC was due Sasebo on the 24th with heavy weather and ice damage. The British DASHWOOD arrived Singapore on July 1 with weather damage. The PACIFIC FORESTER requested a survey for ice damage at Tamano on the 25th.

Other Casualties--The GALLEON EMERALD bound from Balboa to Melbourne suffered heavy weather on the 13th. The Australian IRON HUNTER was at Sydney on the 15th with heavy-weather damage.

THE MARINERS WEATHER LOG WELCOMES ARTICLES AND LETTERS FROM MARINERS RELATING TO METEOROLOGY AND OCEANOGRAPHY, INCLUDING THEIR EFFECTS ON SHIP OPERATIONS.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

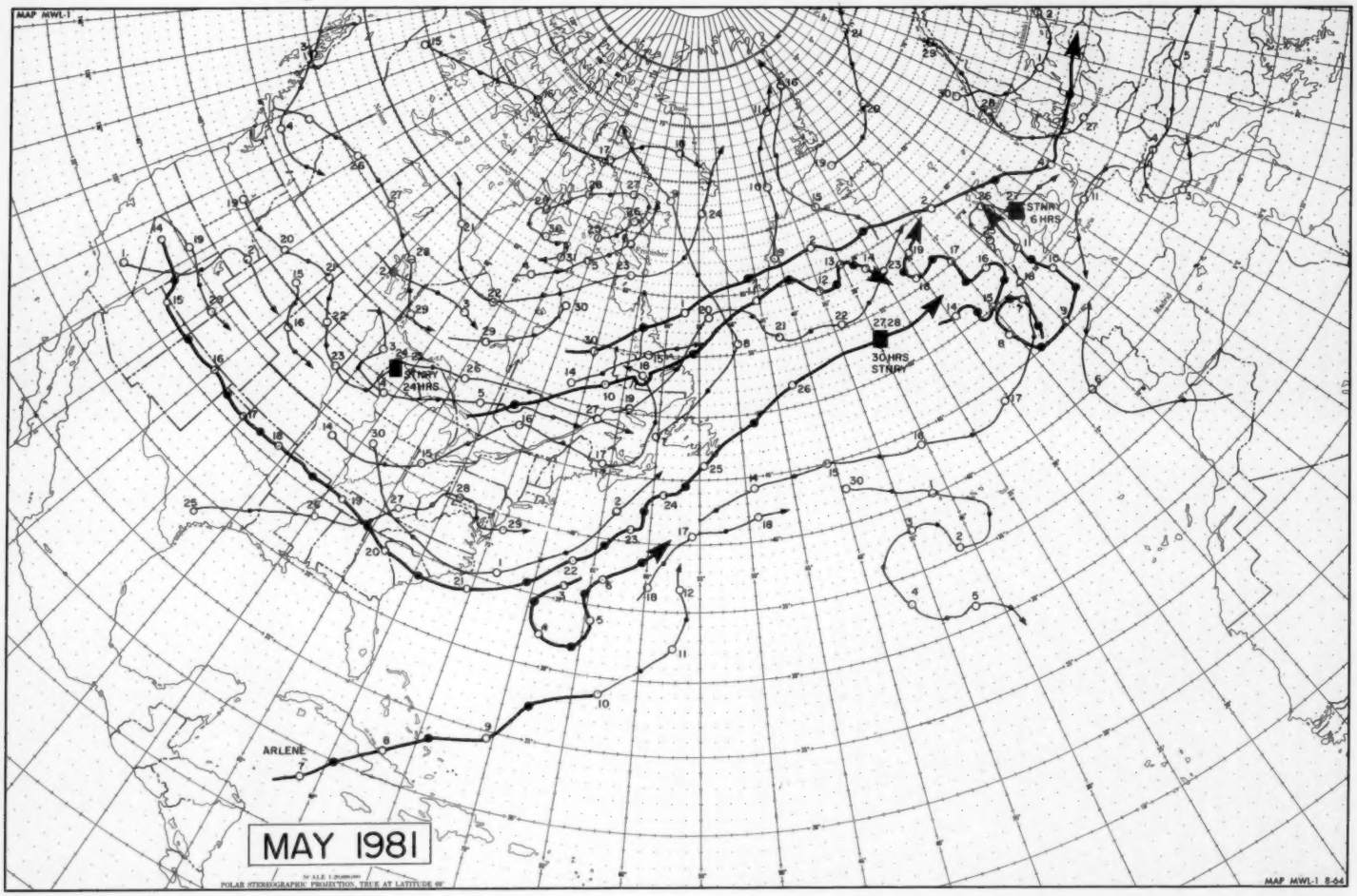


Figure 14. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

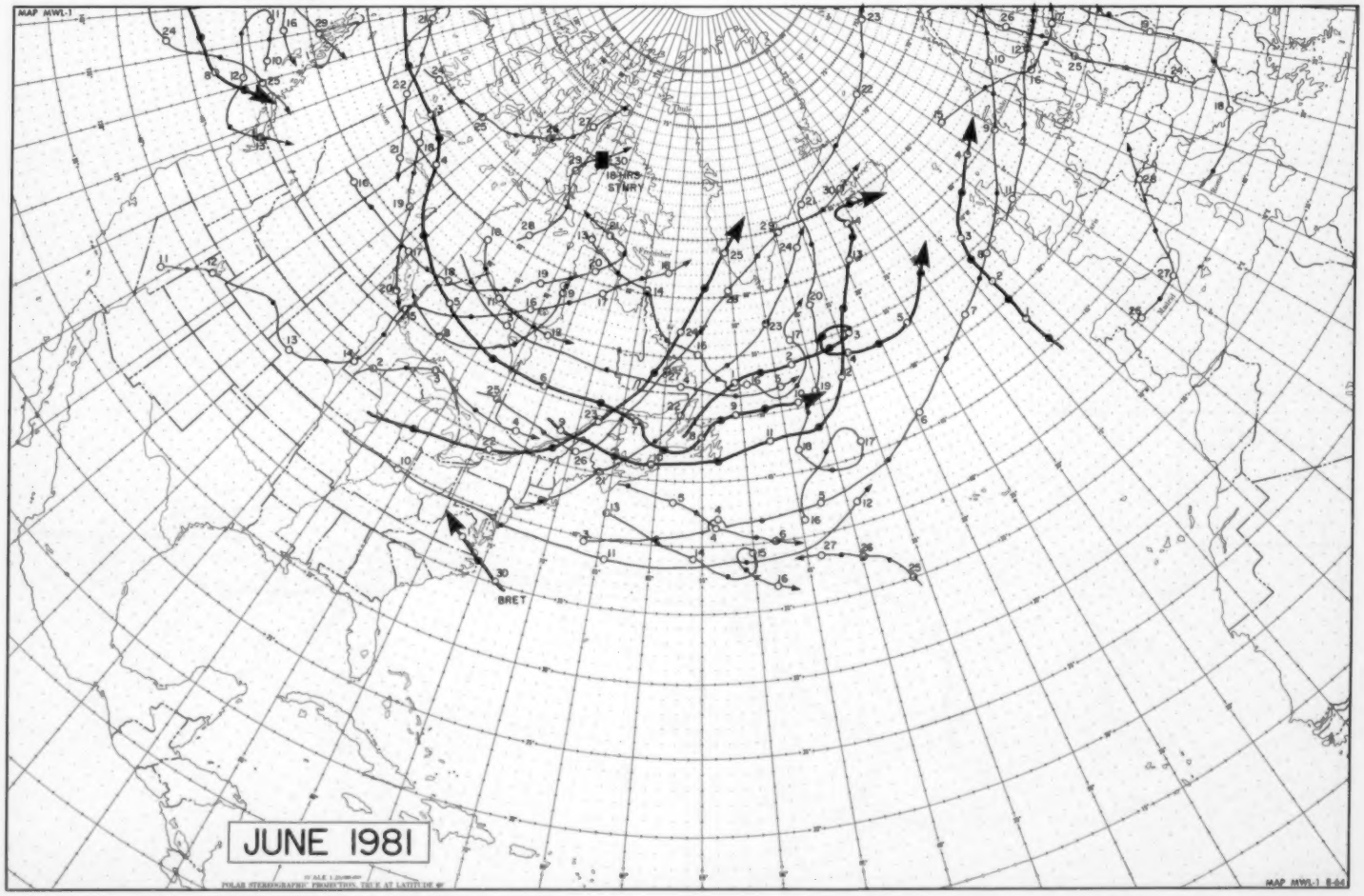


Figure 15. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

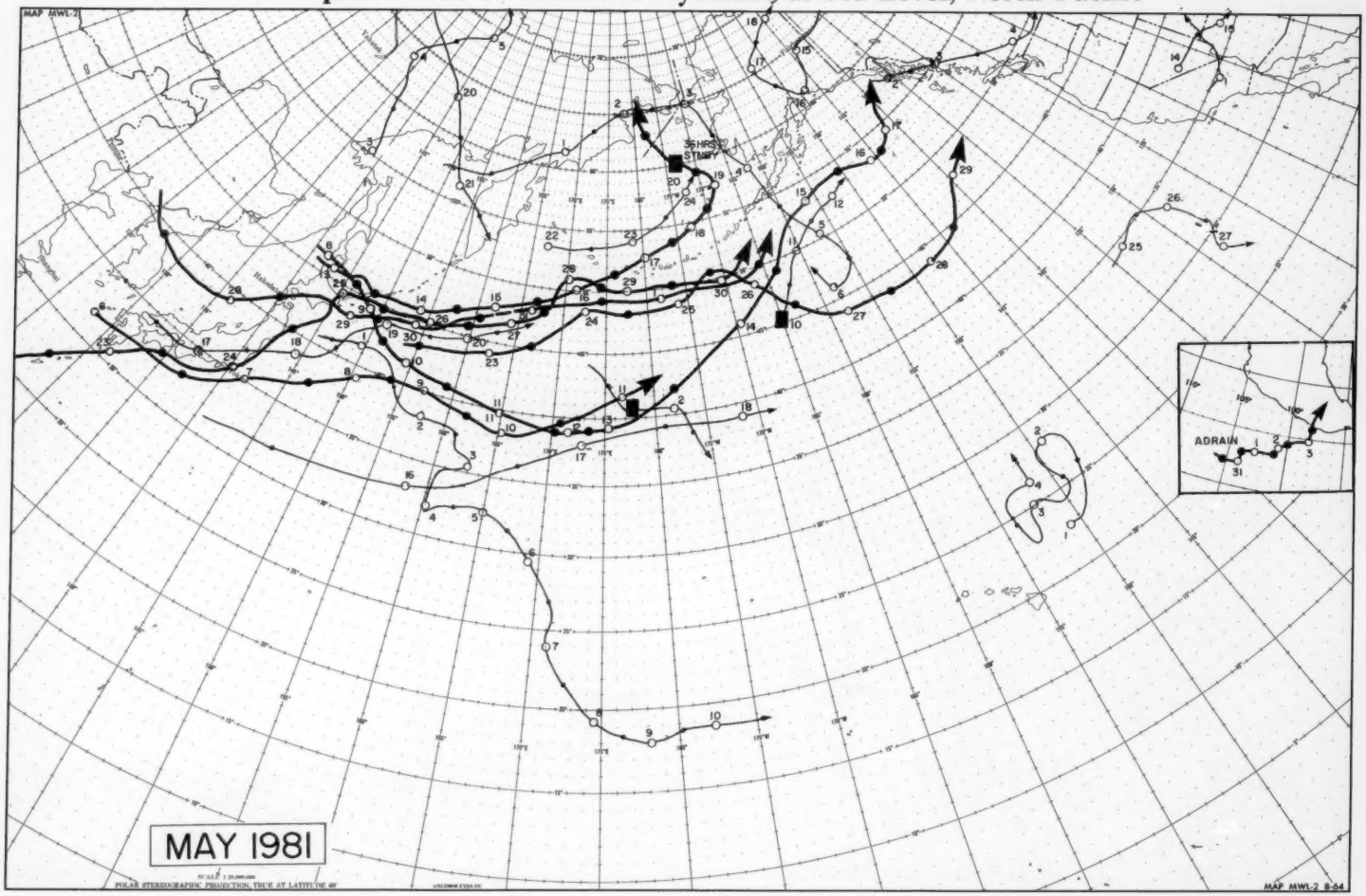


Figure 16.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

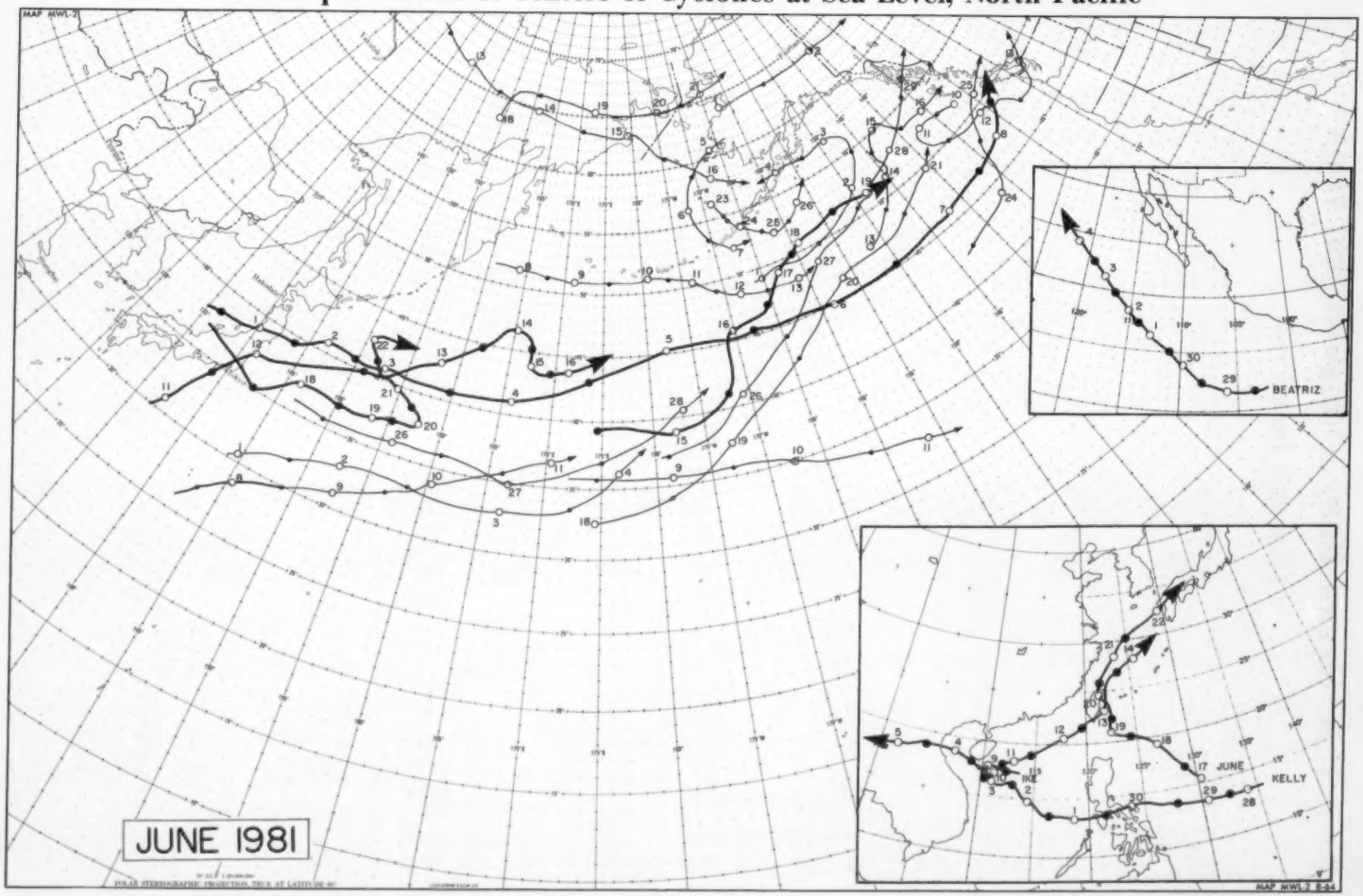


Figure 17.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

U.S. Ocean Buoy Climatological Data

May and June 1981

MAY — DATA SUMMARY — 41002

AVERAGE LATITUDE 32.3N — AVERAGE LONGITUDE 075.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	15.1	(03 06)	22.8	28.7	(30 21)	248	31
SEA TEMP (DEG C)	22.7	(05 00)	24.8	26.8	(16 21)	248	31
AIR-SEA TEMP (DEG C)	-09.2	(03 06)	-02.0	00.5	(30 18)	248	31
PRESSURE (MBAR)	1004.0	(02 09)	1015.1	1023.5	(26 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.2	2.4	5.2	4.8			13.7	16.1
NE		.4					.4	6.0
E	.8	1.6	1.2	1.2			4.8	13.0
SE	.4	1.6	9.7	1.6			13.5	17.0
S	.8	4.0	16.9	6.5			28.2	16.3
SW	.8	3.6	7.7	2.4			14.5	14.0
W	1.6	1.6	7.7	.8			11.7	12.4
NW	1.2	2.8	5.6	3.2			12.9	15.3
CALM	.4						.4	.0
TOTAL	7.3	18.1	54.0	20.6			100.0	15.2

MAX WIND SPEED: 29 KNOTS DIRECTION: 350 DEG DAY: 02 HOUR: 15

NO. OF OBS: 248

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	3.2	41.9	39.1	11.3	4.4				1.9M	5.8M	(05 00)

MAY — DATA SUMMARY — 41003

AVERAGE LATITUDE 30.3N — AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	17.2	(12 19)	23.0	28.5	(31 00)	248	31
SEA TEMP (DEG C)	22.9	(22 09)	23.8	25.9	(01 21)	248	31
AIR-SEA TEMP (DEG C)	-06.7	(12 18)	-00.8	01.9	(11 03)	248	31
PRESSURE (MBAR)	1006.3	(07 21)	1014.5	1021.0	(25 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	9.1	10.5	2.4			21.8	12.8
NE	.8	6.9	1.2				8.9	6.9
E	1.2	3.2	.4				4.8	6.4
SE	.8	4.4	7.3				12.5	11.0
S	2.8	10.9	12.9	.8			27.4	10.5
SW	1.2	5.2	5.6				12.1	9.8
W		3.2	3.2				6.5	10.7
NW	.4	3.2	1.6				5.2	8.2
CALM	.8						.8	.0
TOTAL	8.9	45.2	42.7	3.2			100.0	10.3

MAX WIND SPEED: 24 KNOTS DIRECTION: 010 DEG DAY: 09 HOUR: 00

NO. OF OBS: 248

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 234

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	19.7	67.9	10.3	2.1					1.2M	3.0M	(05 09)

MAY — DATA SUMMARY — 41005

AVERAGE LATITUDE 31.7N — AVERAGE LONGITUDE 079.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	15.8	(12 15)	22.3	29.1	(31 21)	248	31
SEA TEMP (DEG C)	20.6	(10 06)	23.8	27.0	(10 21)	248	31
AIR-SEA TEMP (DEG C)	-08.4	(12 18)	-01.5	02.0	(26 15)	248	31
PRESSURE (MBAR)	1005.4	(07 12)	1014.0	1020.5	(25 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	4.4	6.9	4.4			16.5	15.8
NE	.8	5.2	1.6	.8			8.5	9.9
E	1.2	.8					2.0	4.6
SE		2.4	2.0				4.4	11.5
S	.8	8.9	11.7	1.2			22.6	11.6
SW	.4	6.0	13.7				20.2	12.8
W	1.6	6.0	5.6				13.7	10.4
NW	1.2	4.8	4.4				10.5	9.7
CALM	2.0						2.0	.0
TOTAL	8.9	38.7	46.0	6.5			100.0	11.6

MAX WIND SPEED: 31 KNOTS DIRECTION: 020 DEG DAY: 08 HOUR: 06

NO. OF OBS: 248

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	14.2	64.4	17.8	3.6					1.4M	3.5M	(08 09)

MAY — DATA SUMMARY — 42001

AVERAGE LATITUDE 25.9N — AVERAGE LONGITUDE 089.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.4	(12 03)	25.2	30.1	(27 21)	247	31
SEA TEMP (DEG C)	24.7	(06 09)	25.6	28.0	(27 21)	238	31
AIR-SEA TEMP (DEG C)	-03.7	(12 03)	-00.4	02.1	(27 21)	237	31
PRESSURE (MBAR)	1007.8	(06 21)	1013.5	1018.6	(12 15)	233	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.2						1.2	2.0
NE	4.8	8.2	1.2				14.3	7.9
E	1.2	23.6	36.9				61.9	11.3
SE		1.2	10.7				11.9	13.9
S		1.2	4.8				6.0	11.4
SW		1.2					1.2	9.0
W		1.2					1.2	5.0
NW								
CALM	2.4						2.4	.0
TOTAL	9.8	36.9	53.6				100.0	10.3

MAX WIND SPEED: 19 KNOTS DIRECTION: 110 DEG DAY: 23 HOUR: 18

NO. OF OBS: 94

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 74

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	48.6	51.4							.8M	1.5M	(27 00)

JUNE — DATA SUMMARY — 41002

AVERAGE LATITUDE 32.3N — AVERAGE LONGITUDE 075.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	20.6	(30 18)	26.1	29.1	(24 21)	236	30
SEA TEMP (DEG C)	25.0	(01 03)	26.8	28.9	(25 21)	236	30
AIR-SEA TEMP (DEG C)	-05.9	(30 18)	-00.7	01.2	(10 15)	236	30
PRESSURE (MBAR)	1008.9	(09 21)	1017.8	1023.5	(29 15)	236	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	1.3	4.7	.8			7.2	13.6
NE	.4	1.3	5.1	.8			7.6	16.3
E	.4	5.5	.8				7.2	7.4
SE	.4	7.2	.8				8.5	7.1
S	.4	15.2	17.8				28.4	11.6
SW	.8	3.4	28.4	3.8			36.4	15.1
W		.8	2.5				3.4	11.2
NW		.4	.4				1.3	9.3
CALM								
TOTAL	3.8	30.5	60.6	5.1			100.0	12.6

MAX WIND SPEED: 27 KNOTS DIRECTION: 210 DEG DAY: 07 HOUR: 12

NO. OF OBS: 236

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 236

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	19.5	63.1	16.5	.8					1.2M	3.0M	(07 15)

JUNE — DATA SUMMARY — 41003

AVERAGE LATITUDE 30.3N — AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.8	(08 03)	26.9	29.7	(16 21)	238	30
SEA TEMP (DEG C)	24.3	(01 06)	26.8	30.0	(25 21)	238	30
AIR-SEA TEMP (DEG C)	-03.3	(26 09)	00.1	01.7	(16 21)	238	30
PRESSURE (MBAR)	1010.6	(10 00)	1017.0	1023.7	(29 15)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.7					1.7	7.3
NE		1.7	4.6				6.3	13.4
E		.8	2.9				3.8	13.5
SE	2.5	6.3	3.8				12.6	7.7
S	3.4	22.3	13.0				38.7	8.6
SW	2.1	13.9	7.1				23.1	8.9
W	1.7	7.6	3.8				13.0	7.7
NW	.4	.4					.8	3.5
CALM								
TOTAL	10.1	54.6	35.3				100.0	8.9

MAX WIND SPEED: 20 KNOTS DIRECTION: 180 DEG DAY: 07 HOUR: 03

NO. OF OBS: 238

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 150

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	48.0	44.7	7.3						.9M	2.5M	(29 06)

JUNE — DATA SUMMARY — 41005

AVERAGE LATITUDE 31.7N — AVERAGE LONGITUDE 079.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	24.2	(28 03)	26.9	30.7	(17 21)	239	30
SEA TEMP (DEG C)	24.5	(04 12)	26.9	29.2	(24 18)	239	30
AIR-SEA TEMP (DEG C)	-03.1	(27 03)	00.0	01.7	(17 21)	239	30
PRESSURE (MBAR)	1008.4	(09 21)	1016.3	1024.2	(29 18)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.8					.8	4.0
NE		.4	8.9				9.3	10.4
E	.4	1.3	3.3				5.0	12.4
SE		.8	.4				1.2	10.8
S	.8	14.2	9.6	.8			25.2	9.7
SW	.4	14.6	25.5	1.3			41.8	12.4
W	2.1	9.8	6.3				17.2	9.0
NW		.8					.8	5.8
CALM	2.1						2.1	.0
TOTAL	5.9	41.4	51.0	1.7			100.0	11.0

MAX WIND SPEED: 25 KNOTS DIRECTION: 220 DEG DAY: 07 HOUR: 06

NO. OF OBS: 239

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	31.0	59.7	9.6						1.0M	2.5M	(29 06)

JUNE — DATA SUMMARY — 42001

AVERAGE LATITUDE 25.0N — AVERAGE LONGITUDE 089.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	25.6	(24 12)	28.2	29.6	(21 21)	237	30
SEA TEMP (DEG C)	26.0	(01 12)	27.5	29.1	(21 21)	238	30
AIR-SEA TEMP (DEG C)	-01.3	(24 12)	00.7	02.6	(08 09)	237	30
PRESSURE (MBAR)	1011.0	(06 00)	1015.8	1019.8	(29 18)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N								
NE	2.1	8.0	2.6				12.6	7.4
E	1.7	29.4	34.9				66.0	11.3
SE		6.7	12.6	.8			20.2	13.4
S		.4	.8				1.3	11.7
SW								
W								
NW								
CALM								
TOTAL	3.4	44.5	50.8	.8			100.0	11.2

MAX WIND SPEED: 23 KNOTS DIRECTION: 130 DEG DAY: 18 HOUR: 06

NO. OF OBS: 238

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 238

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	33.2	52.9	13.9						1.1M	2.5M	(14 09)

MAY 42002

D A T A S U M M A R Y

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	20.4	(04 09)	24.7	27.6	(26 21)	247	31
SEA TEMP (DEG C)	24.4	(11 12)	25.3	28.6	(26 21)	247	31
AIR-SEA TEMP (DEG C)	-04.4	(04 09)	-00.7	00.9	(19 15)	247	31
PRESSURE (MBAR)	1007.5	(04 06)	1013.2	1019.2	(11 18)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	3.2	4.5				8.1	11.5
NE	.8	4.0	4.5				9.4	9.7
E	1.2	7.7	15.4				24.3	11.2
SE	.8	19.2	27.1	.4			48.6	11.7
S	1.2	1.6	1.2				4.0	6.7
SW	.4	.4					.8	5.0
W		.8	.4				1.2	8.3
NW		2.8	2.8	.4			5.9	12.8
CALM	.8						.8	.0
TOTAL	5.7	38.1	55.5	.8			100.0	11.1

MAX WIND SPEED: 26 KNOTS DIRECTION: 310 DEG DAY: 04 HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	29.6	61.9	8.5						1.0M	2.5M (16 15)

MAY 42003

D A T A S U M M A R Y

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.8	(12 18)	24.8	27.2	(27 21)	248	31
SEA TEMP (DEG C)	24.9	(01 15)	26.0	28.6	(26 21)	248	31
AIR-SEA TEMP (DEG C)	-04.2	(12 21)	-01.2	00.5	(01 15)	248	31
PRESSURE (MBAR)	1005.9	(06 21)	1013.7	1018.3	(13 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.6	8.1	5.2				14.9	8.4
NE	1.6	5.6	5.2				12.5	8.6
E	3.6	8.9	17.7				30.7	11.0
SE		5.6	10.1				15.7	11.3
S	.8	4.8	.4				6.0	6.3
SW	.4	2.0	.4				2.8	6.7
W	.8	4.0					4.9	5.4
NW	1.2	4.8	3.2				10.1	7.9
CALM	.8						.8	.0
TOTAL	10.9	45.8	42.3				100.0	9.2

MAX WIND SPEED: 20 KNOTS DIRECTION: 100 DEG DAY: 04 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	45.7	50.6	3.6						.8M	2.5M (04 21)

MAY 42007

D A T A S U M M A R Y

AVERAGE LATITUDE 30.1N AVERAGE LONGITUDE 088.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	16.9	(21 06)	22.8	27.7	(30 03)	222	30
SEA TEMP (DEG C)	22.4	(16 21)	24.2	28.6	(01 00)	222	30
AIR-SEA TEMP (DEG C)	-06.6	(21 06)	-01.4	01.2	(24 18)	222	30
PRESSURE (MBAR)	1006.0	(06 09)	1013.9	1019.3	(12 15)	222	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.7	5.1				5.9	14.6
NE		2.6	.7				3.3	7.8
E	1.3	3.3	4.6				9.2	11.0
SE		9.9	16.5				26.3	12.2
S	.7	7.2	11.8	.7			20.4	11.6
SW		3.3	13.8	.7			18.4	13.2
W	2.0	4.6	7.6				9.2	8.2
NW		2.6	5.3				7.9	13.5
CALM	1.3						1.3	.0
TOTAL	5.3	34.9	58.6	1.3			100.0	11.7

MAX WIND SPEED: 23 KNOTS DIRECTION: 220 DEG DAY: 24 HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 220

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	73.6	26.4							.5M	1.5M (06 03)

MAY 42008

D A T A S U M M A R Y

AVERAGE LATITUDE 28.7N AVERAGE LONGITUDE 095.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	17.7	(10 12)	24.5	27.1	(06 00)	247	31
SEA TEMP (DEG C)	23.5	(03 12)	24.8	28.7	(30 03)	247	31
AIR-SEA TEMP (DEG C)	-08.7	(10 12)	-00.3	01.9	(18 18)	247	31
PRESSURE (MBAR)	1005.5	(04 12)	1012.3	1019.6	(11 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			4.5	.8			7.7	14.4
NE	.8	1.6	2.4				4.0	9.8
E	.4	3.2	13.4				17.0	14.5
SE		8.1	25.1	1.6			34.8	14.2
S	.4	6.9	13.8	.4			22.3	11.8
SW	.4	2.4	1.6				4.5	9.0
W		2.4					2.4	6.2
NW	.4	1.2	4.5	.4			6.5	14.3
CALM								
TOTAL	2.4	26.3	66.0	3.2			100.0	13.1

MAX WIND SPEED: 30 KNOTS DIRECTION: 150 DEG DAY: 18 HOUR: 09

MAY 42010

D A T A S U M M A R Y

AVERAGE LATITUDE 29.7N AVERAGE LONGITUDE 093.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	15.2	(20 12)	23.0	26.4	(27 21)	247	31
PRESSURE (MBAR)	1007.5	(06 00)	1012.7	1019.3	(21 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			4.2				4.2	17.5
NE	1.1	2.1	2.1				5.3	7.2
E		1.1	2.1				3.2	11.0
SE	1.1	11.6	33.7				46.3	12.5
S	2.1	13.7	10.5				26.3	9.7
SW		5.2	9.3				9.5	11.1
W		2.1					2.1	6.5
NW		1.1	1.1				2.1	10.0
CALM	1.1						1.1	.0
TOTAL	5.3	36.7	60.8				100.0	11.2

MAX WIND SPEED: 28 KNOTS DIRECTION: 130 DEG DAY: 24 HOUR: 03

JUNE 42002

D A T A S U M M A R Y

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.7	(04 12)	27.6	29.6	(30 00)	239	30
SEA TEMP (DEG C)	26.2	(01 12)	28.0	29.8	(27 21)	239	30
AIR-SEA TEMP (DEG C)	-00.1	(04 12)	-00.4	00.6	(11 15)	239	30
PRESSURE (MBAR)	1007.2	(05 00)	1010.0	1019.0	(29 18)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.8					.8	4.6
NE		3.8	2.1				5.9	8.8
E	.8	21.8	20.9				43.5	11.1
SE	.8	18.8	27.6	.8			47.7	12.3
S		1.7	.4				2.1	10.2
SW								
W								
NW								
CALM								
TOTAL	1.7	46.9	51.0	.8			100.0	11.5

MAX WIND SPEED: 23 KNOTS DIRECTION: 120 DEG DAY: 13 HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	35.6	45.2	18.8	.4					1.0M	2.5M (13 12)

JUNE 42003

D A T A S U M M A R Y

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	24.1	(23 21)	27.9	30.6	(20 21)	239	30
SEA TEMP (DEG C)	26.5	(01 12)	28.4	31.6	(20 21)	239	30
AIR-SEA TEMP (DEG C)	-00.5	(23 21)	-00.6	00.6	(15 09)	239	30
PRESSURE (MBAR)	1012.2	(29 09)	1015.6	1019.5	(29 18)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	5.4					6.3	6.6
NE	2.5	7.9	2.5				8.8	7.9
E	5.0	25.1	24.3				54.4	9.8
SE	2.1	17.5	2.9				19.5	7.3
S	2.1	5.4	.4				7.9	8.7
SW			.4				.4	11.0
W								
NW		2.5					2.5	7.6
CALM	4.2						4.2	.0
TOTAL	16.7	52.7	30.5				100.0	8.2

MAX WIND SPEED: 10 KNOTS DIRECTION: 060 DEG DAY: 20 HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	53.2	43.5	3.3						.8M	2.5M (20 15)

JUNE 42007

D A T A S U M M A R Y

AVERAGE LATITUDE 30.1N AVERAGE LONGITUDE 088.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	24.2	(07 21)	26.1	31.0	(17 21)	232	30
SEA TEMP (DEG C)	27.5	(08 03)	29.3	33.3	(22 21)	232	30
AIR-SEA TEMP (DEG C)	-04.2	(24 21)	-01.5	00.4	(16 00)	231	30
PRESSURE (MBAR)	1015.6	(10 00)	1016.7	1023.7	(29 15)	232	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	3.0	.9				4.3	6.9
NE	.9	2.5	1.3				4.8	8.4
E	.9	2.2	3.0				6.1	10.5
SE		7.0	19.0				26.0	12.6
S		0.1	16.9				26.8	11.8
SW	.9	4.5	14.7				20.3	13.1
W	1.7	4.5	3.0				9.5	8.3
NW	.4	1.7					2.7	6.2
CALM	2.6						2.6	.0
TOTAL	7.5	23.4	58.4				100.0	11.0

MAX WIND SPEED: 20 KNOTS DIRECTION: 130 DEG DAY: 29 HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 178

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	95.3	4.7							.4M	1.0M (14 09)

JUNE 42008

D A T A S U M M A R Y

AVERAGE LATITUDE 28.7N AVERAGE LONGITUDE 095.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.0	(11 12)	27.6	29.0	(10 21)	239	30
SEA TEMP (DEG C)	26.0	(11 12)	27.8	30.4	(10 21)	239	30
AIR-SEA TEMP (DEG C)	-04.4	(11 12)	-00.7	01.3	(13 15)	239	30
PRESSURE (MBAR)	1004.6	(05 00)	1011.5	1019.6	(25 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		2.1	1.3				3.3	10.0
NE	.4	1.7	1.3	.8	.4		4.6	15.4
E	.4	4.6	10.9	.8			16.7	13.0
SE		9.6	30.5	2.5			42.7	14.4
S		4.7	21.3				27.7	12.9
SW		.8	3.8	.4			5.0	13.4
W		.8					.8	6.0
NW								
CALM								
TOTAL	.8	23.1	69.0	4.6	.4		100.0	13.7

MAX WIND SPEED: 30 KNOTS DIRECTION: 030 DEG DAY: 18 HOUR: 09

JUNE 42010

D A T A S U M M A R Y

AVERAGE LATITUDE 29.7N AVERAGE LONGITUDE 093.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.1	(05 09)	27.4	31.6	(23 15)	240	30
PRESSURE (MBAR)	1006.7	(05 15)	1014.2	1020.2	(29 18)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		4.1	1.2				5.8	9.0
NE	.4	4.7	1.2				6.4	8.8
E		4.8	5.3	.8			15.6	10.4
SE	1.2	17.5	13.5	1.2			29.2	11.4
S	.8	12.3	22.8				35.7	11.8
SW		2.1	2.9				5.0	10.3
W		.4					.4	9.0
NW		.8					.4	9.0
CALM	.4						.4	.0
TOTAL	2.9	46.8	47.8	1.8			100.0	10.8

MAX WIND SPEED: 32 KNOTS DIRECTION: 130 DEG DAY: 05 HOUR: 15

MAY — DATA SUMMARY — 44003

AVERAGE LATITUDE 40.8N — AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.8	(07 18)	09.1	14.1	(30 00)	248	31
SEA TEMP (DEG C)	06.2	(05 15)	07.5	09.3	(30 21)	248	31
AIR-SEA TEMP (DEG C)	-00.7	(07 18)	01.6	05.6	(30 00)	248	31
PRESSURE (MBAR)	1002.7	(06 21)	1013.2	1026.2	(09 12)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	4.6	9.1	1.2			15.8	16.4
NE	.8	5.0	8.7	2.9			17.4	13.8
E	.8	10.0	2.9				13.7	7.9
SE		8.3	.4				8.7	7.8
S	1.2	6.6	2.5				10.4	7.5
SW	.8	10.0	.8				11.7	9.6
W	2.5	5.3	2.9				8.7	8.8
NW		2.1	.4				2.5	8.7
CALM	5.4						5.4	.0
TOTAL	12.4	49.8	28.6	9.1			100.0	10.1

NO. OF OBS: 241

MAX WIND SPEED: 31 KNOTS DIRECTION: 240 DEG DAY: 23 HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	3.6	57.5	23.5	7.3	7.7	.4			1.0M	6.0M (23 21)

NO. OF WAVE OBS: 247

MAY — DATA SUMMARY — 44005

AVERAGE LATITUDE 42.7N — AVERAGE LONGITUDE 068.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.0	(04 18)	08.8	12.1	(26 00)	242	31
SEA TEMP (DEG C)	04.2	(07 12)	08.2	10.5	(31 00)	248	31
AIR-SEA TEMP (DEG C)	-02.2	(04 18)	00.6	03.2	(26 00)	242	31
PRESSURE (MBAR)	1003.5	(07 03)	1014.2	1030.2	(09 12)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		3.6	2.1	4.7	.8		9.9	19.8
NE		1.6	8.4	6.8	.8		17.3	19.6
E		3.7	4.2				7.9	12.0
SE	.5	7.3	6.3				14.1	10.8
S		6.3	12.6				18.8	12.1
SW		4.7	8.9	.8			14.1	13.2
W	.5	3.7	3.7	.5			8.4	12.2
NW	.5	3.7	3.1				7.4	10.3
CALM	1.0						1.0	.0
TOTAL	2.6	34.6	49.2	12.6	1.6		100.0	13.8

NO. OF OBS: 191

MAX WIND SPEED: 37 KNOTS DIRECTION: 030 DEG DAY: 23 HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	18.3	63.8	11.0	7.3	1.6				1.0M	5.0M (23 18)

NO. OF WAVE OBS: 245

MAY — DATA SUMMARY — 44006

AVERAGE LATITUDE 36.3N — AVERAGE LONGITUDE 075.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.0	(06 06)	15.1	25.0	(31 21)	248	31
SEA TEMP (DEG C)	10.5	(08 03)	13.9	20.0	(30 21)	248	31
AIR-SEA TEMP (DEG C)	-03.4	(20 06)	01.2	06.3	(28 06)	248	31
PRESSURE (MBAR)	1003.4	(02 00)	1013.5	1020.4	(17 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	6.9	10.9	2.8			21.0	14.4
NE	.8	2.4	9.3	2.4			14.9	15.1
E	.4	2.8	.8				4.0	7.9
SE		6.0	8.5				14.5	11.6
S	.4	14.1	9.7				24.2	10.2
SW	.4	3.6	2.4				6.5	9.2
W	.8	1.6	.4				2.8	7.7
NW	.8	2.8	7.3	1.2			12.1	14.2
CALM								
TOTAL	4.0	40.3	49.2	6.5			100.0	12.3

NO. OF OBS: 248

MAX WIND SPEED: 29 KNOTS DIRECTION: 350 DEG DAY: 21 HOUR: 18

MAY — DATA SUMMARY — 45001

AVERAGE LATITUDE 48.0N — AVERAGE LONGITUDE 087.6W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	02.6	(28 06)	04.8	08.8	(23 03)	104	13
SEA TEMP (DEG C)	02.3	(23 09)	03.5	05.7	(31 21)	104	13
AIR-SEA TEMP (DEG C)	00.4	(28 06)	02.4	06.4	(23 03)	104	13
PRESSURE (MBAR)	0998.5	(30 00)	1012.9	1023.3	(19 00)	104	13

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.0	1.0	1.0				2.9	8.3
NE		4.8	1.0				5.8	8.7
E	1.0	11.5	4.8				17.3	8.3
SE	1.0	8.7	6.7				16.3	9.2
S	2.9	14.4	1.9				19.2	8.6
SW	1.0	15.4	3.8				20.2	7.9
W	1.0	19.2	1.0				21.2	6.9
NW		2.9	1.0				3.8	9.8
CALM	1.0						1.0	.0
TOTAL	8.7	74.0	19.4				100.0	7.4

NO. OF OBS: 104

MAX WIND SPEED: 16 KNOTS DIRECTION: 350 DEG DAY: 30 HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	72.1	24.0	1.0						.5M	2.0M (30 06)

NO. OF WAVE OBS: 104

MAY — DATA SUMMARY — 45002

AVERAGE LATITUDE 45.3N — AVERAGE LONGITUDE 086.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-00.4	(10 12)	04.9	09.6	(23 21)	248	31
SEA TEMP (DEG C)	01.9	(02 12)	02.7	03.4	(31 21)	248	31
AIR-SEA TEMP (DEG C)	-01.0	(10 12)	02.3	06.7	(21 21)	248	31
PRESSURE (MBAR)	1001.6	(30 00)	1016.2	1029.0	(17 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.0	15.7	9.9				26.6	9.1
NE	2.0	2.8	1.2				6.0	6.9
E	.8	.4					1.2	3.7
SE		4.0					4.0	6.4
S	1.2	10.1	2.0				13.3	7.2
SW	2.4	17.3	5.2				25.0	8.2
W	2.8	10.1	.4				13.3	5.1
NW		7.7	.8				8.9	7.0
CALM	2.0						2.0	.0
TOTAL	13.3	68.1	18.5				100.0	7.4

NO. OF OBS: 248

MAX WIND SPEED: 21 KNOTS DIRECTION: 210 DEG DAY: 03 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	69.2	29.4	1.3	.6					.4M	3.0M (03 21)

NO. OF WAVE OBS: 172

JUNE — DATA SUMMARY — 44003

AVERAGE LATITUDE 40.8N — AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.4	(14 09)	12.7	18.7	(22 21)	239	30
SEA TEMP (DEG C)	08.7	(01 03)	10.8	12.5	(13 18)	239	30
AIR-SEA TEMP (DEG C)	-01.3	(14 09)	02.7	06.6	(22 21)	239	30
PRESSURE (MBAR)	0990.2	(09 21)	1013.6	1024.1	(29 15)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.5	7.1	.4				10.0	5.8
NE	.8	1.7	1.3				3.8	6.1
E	2.5	2.7	.4				5.6	5.0
SE	1.7	3.3					5.0	4.3
S		12.6	5.4				18.0	9.4
SW	1.7	11.3	5.4				18.4	8.9
W	2.9	15.9	3.8				22.6	7.7
NW	.4	3.8	1.3				5.4	7.2
CALM	7.1						7.1	.0
TOTAL	19.7	62.3	18.0				100.0	7.0

NO. OF OBS: 239

MAX WIND SPEED: 21 KNOTS DIRECTION: 240 DEG DAY: 09 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	22.4	70.0	7.6						1.2M	2.5M (10 09)

NO. OF WAVE OBS: 170

JUNE — DATA SUMMARY — 44005

AVERAGE LATITUDE 42.7N — AVERAGE LONGITUDE 068.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	13.1	(30 09)	16.9	19.8	(13 18)	54	9
SEA TEMP (DEG C)	09.9	(01 09)	12.7	15.4	(30 21)	235	30
AIR-SEA TEMP (DEG C)	-01.5	(30 09)	01.7	03.9	(25 18)	54	8
PRESSURE (MBAR)	0987.3	(09 21)	1012.6	1026.3	(29 15)	235	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		5.9	5.4				14.3	8.9
NE	1.8	7.1					8.9	7.0
E	1.8	1.8	7.1				10.7	10.2
SE		3.6	1.8				5.4	9.3
S		1.8	19.6	3.6			25.0	16.9
SW		3.6	5.4				8.9	10.6
W		5.4	8.9				14.3	12.7
NW		12.5					12.5	7.9
CALM								
TOTAL	3.6	46.6	48.2	3.6			100.0	11.8

NO. OF OBS: 56

MAX WIND SPEED: 24 KNOTS DIRECTION: 180 DEG DAY: 25 HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	47.2	48.9	3.9						.8M	2.5M (23 06)

NO. OF WAVE OBS: 233

JUNE — DATA SUMMARY — 44006

AVERAGE LATITUDE 36.3N — AVERAGE LONGITUDE 075.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	19.0	(01 21)	23.6	27.9	(15 21)	237	30
SEA TEMP (DEG C)	18.9	(01 21)	22.4	26.8	(21 18)	227	30
AIR-SEA TEMP (DEG C)	-02.9	(18 03)	01.1	06.3	(11 00)	227	30
PRESSURE (MBAR)	1000.1	(09 21)	1014.4	1026.1	(28 18)	237	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.1	2.1	10.2				14.4	11.2
NE	.4	4.7	3.4				8.5	9.7
E	.8	4.7	1.3				6.8	7.6
SE	.8	6.4	1.1				8.9	8.0
S	.8	14.8	15.7				31.4	10.9
SW	.4	4.7	8.9	.4			14.4	12.6
W	1.3	1.3	2.1				4.7	9.1
NW	.4	3.4	2.5	.4			6.8	10.0
CALM	4.2						4.2	.0
TOTAL	11.0	41.9	46.2	.8			100.0	10.0

NO. OF OBS: 236

MAX WIND SPEED: 25 KNOTS DIRECTION: 330 DEG DAY: 30 HOUR: 21

JUNE — DATA SUMMARY — 45001

AVERAGE LATITUDE 48.0N — AVERAGE LONGITUDE 087.6W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	02.6	(22 03)	05.6	10.9	(06 03)	239	30
SEA TEMP (DEG C)	02.6	(01 09)	03.1	03.8	(30 21)	239	30
AIR-SEA TEMP (DEG C)	-00.4	(22 03)	02.5	08.1	(06 03)	239	30
PRESSURE (MBAR)	0992.3	(09 09)	1010.0	1026.2	(30 21)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	3.3	9.1					4.3	5.8
NE	.4	3.0					3.4	6.4
E		4.8	3.4				10.1	9.2
SE	.4	9.0	4.6				13.9	9.2
S	1.7	15.6	4.2				21.5	7.9
SW	.4	12.7	2.5				15.6	8.6
W	2.1	15.6	1.7				22.4	6.9
NW	1.7	4.6					6.3	4.7
CALM	1.3						1.3	.0
TOTAL	9.3	74.3	16.5				100.0	7.6

NO. OF OBS: 237

MAX WIND SPEED: 19 KNOTS DIRECTION: 230 DEG DAY: 18 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	67.2	30.3	2.1	.4					.3M	3.0M (18 21)

NO. OF WAVE OBS: 238

JUNE — DATA SUMMARY — 45002

AVERAGE LATITUDE 45.3N — AVERAGE LONGITUDE 086.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.3	(05 06)	09.5	17.4	(28 21)	237	30
SEA TEMP (DEG C)	03.2	(01 18)	04.8	11.8	(28 00)	238	30
AIR-SEA TEMP (DEG C)	-03.4	(22 06)	02.8	09.1	(06 06)	237	30
PRESSURE (MBAR)	0995.7	(09 00)	1011.0	1024.9	(30 18)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.1	6.8	.4				9.3	5.6
NE	2.5	.4					2.9	2.0
E	3.0	4.4	.9				8.7	5.8
SE	.8	5.5					6.4	5.3
S	3.4	16.1	9.3				28.8	6.7
SW	2.1	15.3	6.4	1.3			25.0	9.1
W	1.3	5.1	.4				6.8	7.0
NW	1.3	4.7	.8				6.8	6.0
CALM	4.2						4.2	.0
TOTAL	20.8	60.2	17.8	1.3			100.0	7.1

NO. OF OBS: 234

MAX WIND SPEED: 24 KNOTS DIRECTION: 210 DEG DAY: 28 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	78.5	17.3	3.4	.8					.3M	3.0M (29 03)

NO. OF WAVE OBS: 237

MAY 45003

DATA SUMMARY

AVERAGE LATITUDE 45.2N AVERAGE LONGITUDE 082.8W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	00.1	(10 18)	04.7	09.8	(20 18)	248	31
SEA TEMP (DEG C)	01.8	(01 06)	02.4	03.1	(28 21)	248	31
AIR-SEA TEMP (DEG C)	-02.1	(10 18)	02.3	07.3	(20 18)	246	31
PRESSURE (MBAR)	1002.7	(30 03)	1016.2	1029.4	(17 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<4	10	21	33	47	>47	
N	1.6	4.1	2.8			8.5	8.1
NE	1.2	4.1	3.3			8.5	8.9
E	2.0	2.0				4.1	5.1
SE	.4	4.9	.4			5.7	6.9
S	.8	9.8	4.5			17.1	9.2
SW	1.2	4.1	.8			6.1	6.6
W	2.8	21.5	7.3			31.7	8.3
NW	1.2	8.5	4.9			14.6	8.5
CALM	1.6					1.6	.0
TOTAL	13.0	61.0	26.0			100.0	8.8

NO. OF OBS: 248

MAX WIND SPEED: 17 KNOTS DIRECTION: 290 DEG DAY: 30 HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	72.5	27.1	.4						.5M	2.0M (30 15)

MAY 45004

DATA SUMMARY

AVERAGE LATITUDE 47.2N AVERAGE LONGITUDE 086.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.5	(28 09)	05.2	10.4	(24 09)	98	13
SEA TEMP (DEG C)	01.9	(28 09)	02.2	02.5	(31 21)	98	13
AIR-SEA TEMP (DEG C)	-00.4	(28 09)	03.0	08.3	(24 09)	98	13
PRESSURE (MBAR)	1021.8	(30 03)	1012.6	1021.6	(19 18)	98	13

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<4	10	21	33	47	>47	
N		8.2	1.0			9.2	8.4
NE	1.0	3.1				4.1	5.0
E	5.1	7.1	2.0			14.3	6.5
SE	2.0	13.3	2.0			17.3	7.2
S	2.0	12.2	2.0			16.3	8.4
SW	2.0	12.2	1.0			15.3	8.3
W	1.0	5.1	3.1			9.2	8.2
NW		2.0	2.0			4.1	11.0
CALM	10.2					10.2	.0
TOTAL	23.5	63.3	13.3			100.0	6.3

NO. OF OBS: 98

MAX WIND SPEED: 22 KNOTS DIRECTION: 310 DEG DAY: 30 HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 98

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	91.8	5.1	3.1						.4M	2.5M (30 09)

MAY 45005

DATA SUMMARY

AVERAGE LATITUDE 41.7N AVERAGE LONGITUDE 082.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.4	(04 12)	11.8	21.9	(22 21)	248	31
SEA TEMP (DEG C)	06.9	(01 15)	10.8	16.9	(27 15)	248	31
AIR-SEA TEMP (DEG C)	-03.8	(06 15)	01.0	07.5	(22 21)	248	31
PRESSURE (MBAR)	1008.7	(11 06)	1018.5	1029.8	(17 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<4	10	21	33	47	>47	
N	.8	1.2	12.2	2.0		16.3	15.4
NE		9.7	12.2			19.0	12.7
E	.4	2.0	12.2			14.7	13.0
SE	.4	3.3	1.6			5.3	9.1
S	.8	7.3	4.5			12.7	9.3
SW	.8	5.3	9.5			15.6	10.0
W	.4	6.1	7.3			13.9	10.6
NW	.4	1.6	4.5			6.5	12.5
CALM	2.0					2.0	.0
TOTAL	6.1	32.7	59.2	2.0		100.0	11.7

NO. OF OBS: 245

MAX WIND SPEED: 27 KNOTS DIRECTION: 310 DEG DAY: 06 HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 243

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	70.0	27.6	2.5						.5M	2.5M (06 12)

MAY 51001

DATA SUMMARY

AVERAGE LATITUDE 23.4N AVERAGE LONGITUDE 162.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	19.6	(02 18)	23.3	28.1	(27 03)	248	31
SEA TEMP (DEG C)	21.4	(04 18)	24.3	28.6	(28 00)	248	31
AIR-SEA TEMP (DEG C)	-01.0	(02 18)	-01.0	00.4	(22 00)	248	31
PRESSURE (MBAR)	1015.0	(06 03)	1019.2	1024.1	(01 09)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<4	10	21	33	47	>47	
N	2.0	4.0	6.5			12.5	10.1
NE	1.2	7.3	22.2	.8		31.5	13.3
E	.4	14.5	34.3			49.6	12.2
SE	1.2	1.2	.4			2.8	4.7
S		1.6				1.6	5.3
SW							
W	.4					.4	3.0
NW	1.6					1.6	2.3
CALM							
TOTAL	7.3	28.6	63.3	.8		100.0	11.8

NO. OF OBS: 248

MAX WIND SPEED: 23 KNOTS DIRECTION: 040 DEG DAY: 01 HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		39.7	54.5	15.4	.4				2.0M	4.0M (28 09)

MAY 41001

DATA SUMMARY

AVERAGE LATITUDE 34.7N AVERAGE LONGITUDE 072.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 213

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	8.2	35.7	38.2	11.3	9.4	1.9	.5		2.2M	6.0M (04 03)

JUNE 45003

DATA SUMMARY

AVERAGE LATITUDE 45.3N AVERAGE LONGITUDE 082.6W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.7	(02 12)	07.4	12.3	(18 21)	118	14
SEA TEMP (DEG C)	02.7	(02 06)	03.6	04.3	(30 21)	120	14
AIR-SEA TEMP (DEG C)	01.8	(25 06)	03.7	08.7	(18 21)	118	14
PRESSURE (MBAR)	1001.7	(22 15)	1015.4	1029.7	(27 15)	120	14

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<4	10	21	33	47	>47	
N		2.5				2.5	6.7
NE		1.7				1.7	5.5
E	.8	4.7				7.6	6.2
SE	.8	6.4	.8			10.1	6.7
S		16.8	8.4			25.2	9.7
SW	.8	9.2	.8			15.9	7.3
W	1.7	19.1	7.6			28.4	8.8
NW	2.5	15.9	.8			19.3	6.7
CALM	3.4					3.4	.0
TOTAL	18.1	71.4	18.5			100.0	7.8

NO. OF OBS: 119

MAX WIND SPEED: 16 KNOTS DIRECTION: ENE DEG DAY: 29 HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 110

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	77.1	22.9							.5M	1.5M (29 09)

JUNE 45004

DATA SUMMARY

AVERAGE LATITUDE 47.2N AVERAGE LONGITUDE 086.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	03.3	(22 06)	06.2	10.6	(15 09)	237	30
SEA TEMP (DEG C)	02.4	(02 12)	02.9	03.3	(30 21)	238	30
AIR-SEA TEMP (DEG C)	00.3	(22 06)	03.3	07.7	(15 09)	237	30
PRESSURE (MBAR)	0992.7	(08 09)	1010.3	1027.6	(30 18)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<4	10	21	33	47	>47	
N		5.5	.8			6.3	6.3
NE						.8	5.0
E	.4	4.2	3.0			7.6	6.7
SE	3.7	11.0	3.1			17.7	6.7
S	.4	11.8	7.6			19.8	9.6
SW	1.3	4.6	.4			6.3	6.2
W	2.5	11.0	5.1			18.6	8.1
NW	.4	8.0	1.7			10.1	7.7
CALM	10.5					10.5	.0
TOTAL	17.1	59.1	23.6			100.3	7.5

NO. OF OBS: 237

MAX WIND SPEED: 18 KNOTS DIRECTION: 270 DEG DAY: 16 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 237

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	77.6	21.5	.8						.5M	2.0M (19 03)

JUNE 45005

DATA SUMMARY

AVERAGE LATITUDE 41.7N AVERAGE LONGITUDE 082.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	12.0	(01 09)	15.6	20.4	(29 21)	239	29
SEA TEMP (DEG C)	13.7	(01 12)	18.7	22.0	(30 18)	239	29
AIR-SEA TEMP (DEG C)	-02.4	(17 15)	00.9	04.2	(16 06)	229	29
PRESSURE (MBAR)	0997.1	(09 06)	1012.2	1026.2	(27 15)	239	29

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<4	10	21	33	47	>47	
N		.6	1.9			2.5	12.8
NE	.8		9.2			9.0	12.5
E	1.2	3.1	9.2			13.7	11.6
SE	.8	2.1	4.3			7.3	10.3
S	.8	3.1	4.3			8.1	10.2
SW		7.5	12.9			20.7	11.0
W	.8	3.9	6.0			10.4	12.0
NW		4.3	3.7			8.1	10.9
CALM	.8					.8	.0
TOTAL	4.3	24.6	67.1			100.0	11.4

NO. OF OBS: 161

MAX WIND SPEED: 18 KNOTS DIRECTION: 310 DEG DAY: 17 HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 204

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	81.6	18.4							.4M	1.5M (25 09)

JUNE 51001

DATA SUMMARY

AVERAGE LATITUDE 23.4N AVERAGE LONGITUDE 162.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.0	(09 15)	24.8	28.7	(29 03)	180	30
SEA TEMP (DEG C)	24.9	(08 18)	25.9	28.1	(29 03)	178	30
AIR-SEA TEMP (DEG C)	-02.1	(09 15)	-00.6	01.3	(09 03)	178	30
PRESSURE (MBAR)	1016.3	(25 03)	1019.3	1022.1	(20 09)	142	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<4	10	21	33	47	>47	
N						
NE		7.6	28.9			36.6	13.6
E		5.3	42.6			47.9	13.9
SE			.6			.6	12.0
S							
SW							
W							
NW							
CALM							
TOTAL		7.9	92.1			100.0	13.8

NO. OF OBS: 190

MAX WIND SPEED: 20 KNOTS DIRECTION: 080 DEG DAY: 30 HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 192

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		45.8	54.2						1.8M	2.5M (30 12)

JUNE 41001

DATA SUMMARY

AVERAGE LATITUDE 32.6N AVERAGE LONGITUDE 078.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.5	(27 00)	25.0	28.7	(26 00)	39	6
SEA TEMP (DEG C)	27.1	(29 15)	28.8	29.7	(25 18)	39	6
AIR-SEA TEMP (DEG C)	-03.6	(27 00)	-01.9	-00.1	(26 12)	39	6
PRESSURE (MBAR)	1016.8	(26 18)	1019.9	1023.1	(29 15)	39	6

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<4	10	21	33	47	>47	
N	2.6					2.6	3.1
NE		2.6	43.6			46.2	15.3
E		7.7	7.7			15.4	10.2
SE		2.6				2.6	9.0
S	2.6	2.6	2.6			7.7	8.4
SW		4.1	12.8			17.9	12.6
W		5.1				5.1	8.0
NW	2.6					2.6	3.8
CALM							
TOTAL	7.7	25.6	66.7			100.0	12.3

NO. OF OBS: 39

MAX WIND SPEED: 19 KNOTS DIRECTION: 060 DEG DAY: 27 HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 36

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	18.6	57.9	23.7						1.3M	2.0M (29 21)

MAY 42009

D A T A S U M M A R Y

AVERAGE LATITUDE 29.3N AVERAGE LONGITUDE 087.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
SEA TEMP (DEG C)	22.4	(12 15)	24.0	25.2	(06 18)	116	15
PRESSURE (MBAR)	1005.8	(06 21)	1013.4	1019.0	(13 15)	116	15

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	%	MEAN SPEED (KNOTS)
N		2.6	12.1				14.7	11.9
NE	.9	4.9	5.2				12.9	9.9
E	.9	6.0	2.6				9.5	7.7
SE	.9	1.7	17.2	.9			20.7	14.3
S	.9	6.0	2.6				9.5	7.8
SW		3.4	3.4				6.9	9.8
W	.9	4.9	5.2				12.9	9.1
NW	.9	7.8	4.3				12.9	9.0
CALM								
TOTAL	5.2	41.4	52.6	.9			100.0	10.4

NO. OF OBS: 116

MAX WIND
SPEED: 23 KNOTS
DIRECTION: 140 DEG
DAY: 06
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 115

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	41.7	46.3	13.0	.9					1.0M	3.0M	(06 06)

MAY 46004

D A T A S U M M A R Y

AVERAGE LATITUDE 39.0N AVERAGE LONGITUDE 070.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.0	(08 00)	11.4	17.2	(11 21)	126	16
SEA TEMP (DEG C)	07.7	(08 12)	10.3	14.1	(14 18)	126	16
AIR-SEA TEMP (DEG C)	-04.1	(04 12)	01.1	04.8	(12 03)	126	16
PRESSURE (MBAR)	1003.5	(02 00)	1013.6	1025.9	(09 03)	126	16

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	%	MEAN SPEED (KNOTS)
N		4.0	21.4	11.1	2.4		38.9	19.9
NE		5.6	11.1				16.7	11.0
E		4.0	3.2				7.1	10.1
SE			5.6				5.6	12.3
S	.8	5.6	7.9				14.3	11.3
SW		2.4	1.6				4.0	9.4
W		1.6	6.3				7.9	15.3
NW		3.2	1.6	.8			5.6	13.9
CALM								
TOTAL	.8	26.2	58.7	11.9	2.4		100.0	14.9

NO. OF OBS: 126

MAX WIND
SPEED: 36 KNOTS
DIRECTION: 330 DEG
DAY: 03
HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 126

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		60.3	29.4	4.8	5.6				1.8M	4.5M	(04 06)

JUNE 46002

D A T A S U M M A R Y

AVERAGE LATITUDE 42.8N AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.6	(12 12)	13.8	15.8	(19 00)	237	30
SEA TEMP (DEG C)	13.7	(01 15)	14.9	17.1	(25 00)	237	30
AIR-SEA TEMP (DEG C)	-03.6	(25 15)	-01.4	00.7	(08 00)	237	30
PRESSURE (MBAR)	1008.9	(07 12)	1021.1	1033.0	(27 00)	237	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	3.4	9.7				13.5	14.1
NE								
E			.4	.4			.8	19.6
SE	.4		.4				.8	7.0
S		2.5	2.1				4.6	10.5
SW	.4	5.9	12.2				18.6	12.3
W	.4	13.9	28.7	.4			43.5	12.4
NW	.4	4.6	12.7				17.7	11.9
CALM	.4						.4	.0
TOTAL	2.5	30.4	66.2	.8			100.0	12.4

NO. OF OBS: 237

MAX WIND
SPEED: 22 KNOTS
DIRECTION: 280 DEG
DAY: 13
HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 237

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		45.6	50.2	3.8	.4				1.8M	4.0M	(22 18)

JUNE 46005

D A T A S U M M A R Y

AVERAGE LATITUDE 46.0N AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.1	(12 09)	11.8	12.9	(26 21)	240	30
SEA TEMP (DEG C)	10.4	(14 09)	11.8	12.6	(29 03)	239	30
AIR-SEA TEMP (DEG C)	-02.8	(12 09)	-00.2	01.4	(14 09)	239	30
PRESSURE (MBAR)	1001.8	(06 12)	1017.4	1033.3	(27 00)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			2.1	2.1			4.2	11.7
NE			.4				.4	4.0
E			.4				.4	4.0
SE		.4	2.9	1.7			5.0	6.8
S		7.1	5.4				12.5	10.6
SW		17.5	10.8				23.3	10.3
W		1.3	6.3	31.7			39.2	12.8
NW			3.8	10.0	.4		14.2	13.8
CALM		.8					.8	.0
TOTAL		2.5	35.4	61.7	.4		100.0	11.6

NO. OF OBS: 240

MAX WIND
SPEED: 27 KNOTS
DIRECTION: 320 DEG
DAY: 13
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		.8	43.3	41.3	12.5	2.1			1.9M	4.5M	(22 21)

JUNE 46010

D A T A S U M M A R Y

AVERAGE LATITUDE 48.2N AVERAGE LONGITUDE 129.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	12.3	(23 12)	13.9	15.7	(25 03)	64	9
SEA TEMP (DEG C)	13.0	(26 12)	13.8	17.9	(23 21)	64	9
AIR-SEA TEMP (DEG C)	-03.8	(23 12)	-01.5	00.7	(29 19)	64	9
PRESSURE (MBAR)	1015.5	(30 12)	1020.9	1026.7	(27 00)	64	9

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			6.9	28.6			37.5	12.8
NE			3.8				3.6	5.5
E								
SE		3.6					3.6	3.0
S			1.8				1.8	5.0
SW								
W		1.8	3.6				5.4	5.4
NW			28.6	19.6			48.2	10.3
CALM								
TOTAL		5.4	44.4	48.2			100.0	10.5

NO. OF OBS: 56

MAX WIND
SPEED: 19 KNOTS
DIRECTION: 350 DEG
DAY: 25
HOUR: 03

JUNE 46006

D A T A S U M M A R Y

AVERAGE LATITUDE 47.5N AVERAGE LONGITUDE 090.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.0	(23 06)	07.2	10.9	(29 21)	64	9
SEA TEMP (DEG C)	03.9	(26 15)	04.7	08.2	(30 15)	59	9
AIR-SEA TEMP (DEG C)	00.6	(30 21)	02.5	05.5	(28 18)	59	9
PRESSURE (MBAR)	1006.4	(24 15)	1016.0	1027.9	(30 18)	63	9

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.6					1.6	3.0
NE		1.6	6.3				7.8	6.6
E		9.4	4.7	4.7			18.8	6.8
SE		6.3	10.9	1.6			18.8	6.5
S		4.7	7.8	1.6			14.1	6.2
SW		3.1	3.1				6.3	4.3
W		6.3	9.4	4.7			18.8	6.3
NW		1.6	3.1				4.7	4.3
CALM		7.8					7.8	.0
TOTAL		42.2	45.3	12.5			100.0	5.6

NO. OF OBS: 64

MAX WIND
SPEED: 15 KNOTS
DIRECTION: 100 DEG
DAY: 24
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 59

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	94.9	5.1							.2M	1.0M	(24 18)

JUNE 46001

D A T A S U M M A R Y

AVERAGE LATITUDE 56.0N AVERAGE LONGITUDE 148.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.1	(03 15)	09.8	12.3	(21 03)	238	30
SEA TEMP (DEG C)	07.5	(02 18)	10.1	12.4	(13 03)	238	30
AIR-SEA TEMP (DEG C)	-02.6	(04 06)	-00.3	01.5	(05 21)	238	30
PRESSURE (MBAR)	0982.6	(03 12)	1010.5	1026.9	(27 00)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			1.5				1.5	13.1
NE			6.1				6.1	13.3
E			1.5				1.5	11.1
SE		1.5	3.0				4.5	10.3
S	1.5	9.1	7.6				18.2	10.0
SW		12.1	9.1				21.2	9.7
W		21.2	18.7	1.5			39.4	10.3
NW	1.5	6.1					7.6	7.0
CALM								
TOTAL	3.0	50.0	45.5	1.5			100.0	10.1

NO. OF OBS: 66

MAX WIND
SPEED: 22 KNOTS
DIRECTION: 250 DEG
DAY: 30
HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 237

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		29.2	61.4	7.2	2.1				1.3M	3.0M	(30 15)

JUNE 46004

D A T A S U M M A R Y

AVERAGE LATITUDE 51.0N AVERAGE LONGITUDE 136.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.1	(06 21)	09.9	11.8	(26 03)	239	30
SEA TEMP (DEG C)	08.3	(04 15)	09.8	11.3	(27 03)	239	30
AIR-SEA TEMP (DEG C)	-01.7	(24 09)	00.2	01.3	(22 21)	239	30
PRESSURE (MBAR)	0986.1	(06 18)	1017.7	1035.6	(27 00)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.7	2.5				4.2	11.8
NE		5.4	2.1				7.5	10.4
E	.4	5.4	2.1	2.1			10.0	13.3
SE	.8	5.0	2.1	2.1			11.7	13.2
S	.4	7.1	6.7	1.7			15.9	12.4
SW		7.9	11.3	1.3			17.6	16.9
W		5.0	13.0	2.9			20.9	14.8
NW		2.5	9.6	.4			12.6	13.5
CALM								
TOTAL	1.7	33.5	52.3	12.6			100.0	13.8

NO. OF OBS: 239

MAX WIND
SPEED: 32 KNOTS
DIRECTION: 240 DEG
DAY: 29
HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 230

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	7.1	48.5	30.1	14.2	2.0				1.4M	3.5M	(29 06)

JUNE 46006

D A T A S U M M A R Y

AVERAGE LATITUDE 40.7N AVERAGE LONGITUDE 137.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.7	(11 15)	15.1	18.7	(29 03)	240	30
SEA TEMP (DEG C)	12.7	(09 12)	14.2	17.2	(29 03)	240	30
AIR-SEA TEMP (DEG C)	-02.4	(11 15)	00.7	03.2	(21 00)	240	30
PRESSURE (MBAR)	1007.1	(07 12)	1023.3	1038.8	(27 00)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	2.5	3.3				6.7	8.8
NE	.8	5.9					6.7	5.6
E	.8	1.7	.4				2.9	6.2
SE		1.7	.8				2.5	9.8
S	.4	1.7	7.5	1.3			10.9	15.1
SW		.8	19.2	.8			20.9	16.4
W		5.9	24.3	.8			31.0	13.8
NW	.8	5.4	11.7	.8			18.8	12.8
CALM								
TOTAL	3.8	25.4	67.4	3.3			100.0	13.1

NO. OF OBS: 239

MAX WIND
SPEED: 29 KNOTS
DIRECTION: 280 DEG
DAY: 08
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		5.8	47.1	42.5	4.7				1.7M	3.0M	(04 03)

JUNE 46011

D A T A S U M M A R Y

AVERAGE LATITUDE 34.9N AVERAGE LONGITUDE 120.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.0	(01 15)	13.4	20.1	(15 18)	238	30
SEA TEMP (DEG C)	11.0	(15 09)	13.0	16.7	(23 00)	238	30
AIR-SEA TEMP (DEG C)	-02.7	(26 15)	00.5	08.4	(15 18)	238	30
PRESSURE (MBAR)	1004.8	(09 03)	1012.0	1018.6	(19 18)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.3	7.6	4.2				13.0	8.7
NE								
E	.4						.4	1.0
SE	1.3	.8					2.1	3.6
S	1.7	1.3					2.9	4.3
SW	1.3	.8					2.1	2.8
W	3.8	3.4					7.6	4.2
NW	2.5	12.2	45.0	6.3			66.0	15.0
CALM	5.9						5.9	.0
TOTAL	18.1	26.5	49.2	6.3			100.0	11.6

NO. OF OBS: 238

MAX WIND
SPEED: 28 KNOTS
DIRECTION: 320 DEG
DAY: 13
HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 235

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		28.9	58.6	12.6	.9				1.3M	4.0M	(13 06)

Continued on page 416.

Selected Gale and Wave Observations, North Atlantic

May and June 1981

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. true	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves* Period sec.	Sea Waves* Height ft.	Swell Waves Dir. true	Swell Waves Period sec.*	Swell Waves Height ft.
NORTH ATLANTIC OCEAN		MAY															
SEALAND MARKET	KJVG	3	13.4 N	71.8 W	18	35	45	2 NM	02	1005.5	11.7	10.0	10	11.5	03	< 6	14.5
AMERICAN ACE	KFCV	3	36.2 N	70.9 W	18	03	45	1 NM	50	1005.5	8.9	11.1	4	13	03	6	16.5
NANTUCKET II	KNPN	3	40.5 N	69.5 W	21	04	N 40	2 NM	10	1009.0	6.5	7.8	4	13	04	7	19.5
ESSO NASSAU	6ZMI	3	36.5 N	72.4 W	23	36	50	5 NM	02	1011.5	15.8	24.0			36		23
AMERICAN ACE	KFCV	4	36.5 N	69.8 W	00	03	45	1 NM	52	1004.5	10.6	15.6	6	23	03	6	23
NANTUCKET II	KNPN	4	40.5 N	69.5 W	03	04	N 35	5 NM	10	1011.0	6.5		5	8	04	< 6	28
SOCONY VACUUM	KIRL	4	34.1 N	75.9 W	12	36	35	10 NM	02	1015.2	21.1	24.5	3	5	36	8	41
AMERICAN LEGACY	KFCJ	4	36.6 N	73.2 W	12	36	35	5 NM	03	1007.8	16.1	23.3	7	26	03	8	26
MORINGUE:	KPCV	4	31.0 N	73.1 W	18	34	35	10 NM	02	1011.0	22.2	18.9	10	10	34	9	16.5
KENNETH F HILL	DSOD	4	35.4 N	74.4 W	18	36	N 36	10 NM	03	1013.0	18.0		8	16.5	09	12	10
KENNETH F HILL	DSOD	5	36.2 N	73.9 W	00	02	N 42	10 NM	02	1011.5	15.0		9	19.5	06	12	16.5
MORINGUE:	KPCV	5	31.8 N	74.0 W	00	32	35	10 NM	02	1011.0	19.4	20.0					
SEALAND CONSUMER	WCHF	5	27.3 N	67.5 W	00	27	35	10 NM	15	1010.0	21.5	23.4	3	10	30	< 6	13
CHEVRON SOUTH AMERICA	SMOZ	6	26.0 N	84.5 W	12	19	N 35	5 NM	02	1010.0	24.0	25.0		6.5	19	< 6	6.5
VANGUARD	HIOR	7	59.9 N	07.8 W	00	17	N 37	5 NM	03	0995.9	10.0	8.9	3	6.5	16	6	11.5
AMERICAN ALLIANCE	KFEH	7	49.7 N	07.7 W	06	11	35	5 NM	21	0994.1	11.1	11.0	5	5	13	< 6	10
AMERICAN LEGEND	KFEY	7	50.0 N	12.3 W	18	35	43	5 NM	02	0985.0	10.0	12.3	8	14.5	35	8	16.5
AMERICAN LEGEND	KFEY	8	50.0 N	14.4 W	00	35	45	5 NM	02	0995.9	8.9	11.1	9	16.5	35	9	16.5
AMERICAN CHARGER	KGTR	8	48.8 N	21.5 W	06	02	40	5 NM	01	1013.0	7.7	14.0	7	14.5	36	7	14.5
GULF TRADER	KRMI	8	48.8 N	16.2 W	12	35	40	5 NM	02	0999.6	11.2	11.2	3	13	36	< 6	23
DART EUROPE	DNDA	8	47.6 N	17.4 W	12	36	N 45	5 NM	25	1008.2	9.3	12.0	5	16	36	7	19.5
NORAL SEL	LDFF	9	45.2 N	18.3 W	12	33	45	10 NM	01	1005.0	12.0	14.0	10	16.5	XX		
GULF TRADER	KRMI	9	43.0 N	15.9 W	12	33	35	10 NM	15	1000.2	12.3	13.4	3	8	33	7	23
AMERICAN CHARGER	KGTR	10	45.6 N	40.1 W	06	35	35	10 NM	02	1021.8	10.6	15.5	5	14.5	36	7	13
SEALAND GALLOWAY	KHLX	10	49.3 N	14.2 W	06	35	35	10 NM	02	0995.2	10.0	9.5	5	10	35	7	19.5
DART EUROPE	DNDA	10	47.7 N	36.1 W	06	33	N 39	10 NM	63	1011.2	9.8	14.0	5	14.5			
DEL ORO	WLCJ	10	07.1 N	12.7 W	06	08	50	50 YD	64		21.6	28.8	6	8	08	>13	18
PIONEER CONTENDER	WMFC	10	42.9 N	37.4 W	12	34	40	5 NM	62	1018.2	12.8	14.4	7	16.5	34	7	16.5
AMERICAN LEGEND	KFCY	10	46.9 N	40.3 W	12	34	40	10 NM	02	1022.0	14.5	14.5	8	16.5	34	8	16.5
FALSTRIA	DYRG	12	33.3 N	53.5 W	06	15	N 42	1 NM	59	1012.0	20.0	20.0					
ADM WM M CALLAGHAN	KGYE	12	54.2 N	27.6 W	07	29	35	10 NM	15	1010.0	6.1	10.6	4	8	27	< 6	6.5
MARINE CHEMICAL TRANSPRT	KVNZ	12	22.2 N	85.5 W	18	01	15	10 NM	03	1014.0	27.5	28.9	2	6.5	02	< 6	26.5
DOCTOR LYKES	KHNB	14	47.2 N	19.5 W	12	30	33	10 NM	02	0997.6	14.4	13.9	5	13	30	8	19.5
SEA LAND VOYAGER	KHPK	14	48.6 N	27.5 W	12	33	N 40	10 NM	18	1010.0	13.0	13.0	7	11.5	33	7	11.5
AMERICAN ALLIANCE	KFEH	14	48.0 N	30.5 W	18	33	40	10 NM	64	1014.6	10.0	14.5	4	16.5	33	10	19.5
AMERICAN ARCHER	KFCS	14	49.6 N	28.5 W	18	31	35	10 NM	02	1007.5	10.0	13.4	7	11.5	31	11	24.5
JUTHLANDIA	ELYV	14	49.7 N	16.7 W	18	30	35	10 NM	25	0993.8	9.3	8.2	6	13	30	9	13
AMERICAN ARCHER	KFCS	15	49.3 N	30.6 W	00	31	35	10 NM	02	1012.5	7.2	13.3	7	13	31	9	18
SEA LAND VOYAGER	KHPK	15	48.4 N	23.8 W	00	33	N 40	10 NM	02	1003.0	9.0	13.0	7	11.5	33	7	11.5
ITALICA	IBHL	15	40.0 N	20.4 W	12	32	22	10 NM	18	1020.5	16.0	15.5	4	24.5			
TFL EXPRESS	9VPU	16	49.2 N	16.2 W	12	33	N 52	10 NM	02	0998.3	12.5	12.8	XX		31	10	26
ASIA HONESTY	ABLL	16	45.6 N	41.2 W	18	26	N 40	5 NM	03	1010.0	12.0	19.0	7	29.5	28	7	29.5
ASIA HONESTY	ABLL	17	46.1 N	39.7 W	00	06	N 40	10 NM	03	1014.0	13.0	17.0	7	29.5	05	8	29.5
AMERICAN ARGOSY	KFCX	17	46.4 N	35.8 W	00	07	35	5 NM	61	1012.5	10.6	14.0	3	6.5	08	< 6	11.5
ASIA HONESTY	ABLL	18	47.4 N	33.6 W	00	34	N 35	10 NM	03	1011.0	11.0	16.0	6	19.5	34	7	19.5
TFL EXPRESS	9VPU	18	48.6 N	30.7 W	00	34	N 50	5 NM	61	1006.0	10.5	12.8					
TFL FREEDOM	9VYX	19	45.6 N	28.9 W	12	34	N 36	5 NM	02	1007.0	13.0	15.0	5	19.5	36	7	19.5
ASIA HONESTY	ABLL	20	49.5 N	16.2 W	12	04	N 40	10 NM	05	1002.0	12.0	15.0	6	23	04	7	23
KENNETH F HILL	DSOD	20	33.0 N	75.0 W	18	22	N 35	5 NM	80	1014.5	21.0		4	6.5			
RODRIGUES CARRILHO	CSOU	21	33.9 N	52.6 W	18	27	40	> 25 NM	01	1009.8	19.0	19.0		6.5	27		6.5
RODRIGUES CARRILHO	CSOU	22	34.0 N	54.0 W	06	27	40	10 NM	00	1001.0	15.0	20.0		16.5	27		16.5
ASIA BRAVERY	ABCM	22	48.5 N	24.7 W	12	30	N 43	5 NM	02	1008.0	12.0	13.0	6	5	29	11	11.5
DORIC	3FYT	22	37.5 N	70.2 W	18	01	N 35	5 NM	02	1010.0	22.5	24.0	7	10			
SEALAND GALLOWAY	KHLX	22	47.4 N	19.8 W	18	27	35	5 NM	02	1010.0	15.6	12.2	6	10	27	9	16.5
OLEANDER	PJVG	23	37.0 N	70.6 W	00	36	35	5 NM	02	1006.9	19.0		6	6.5	01	10	14.5
SEALAND GALLOWAY	KHLX	23	46.4 N	12.8 W	06	28	35	10 NM	01	1009.2	10.0	11.7	7	11.5	28	10	16.5
NANTUCKET II	KNPN	23	40.5 N	69.5 W	18	01	N 40	5 NM	02	1008.0	9.4	9.5	4	10	01	< 6	19.5
CLARA MAERSK	OWIK	24	39.2 N	59.9 W	18	25	35	10 NM	25	0995.0	17.5		10	10			
SEALAND RACER	KSLB	24	38.8 N	54.9 W	18	29	N 35	5 NM	01	1001.7	21.1	22.2	5	6.5	28	< 6	8
AMERICAN ACE	KFCV	24	42.9 N	66.2 W	18	36	45	5 NM	02	1002.0	7.8	5.6	3	6.5	34	< 6	10
ROBERT E LEE	KCRD	24	36.2 N	55.8 W	18	19	N 46	5 NM	02	1006.8	19.4	20.3	5	3	23	11	8
RED JACKET	KAAJ	24	36.9 N	55.7 W	18	22	35	10 NM	02	1004.7	23.3	20.0	5	8	23	8	14.5
ROBERT E LEE	KCRD	25	36.2 N	57.2 W	00	20	N 39	10 NM	02	1007.5	18.3	20.6	12	16.5	20	13	19.5
CLARA MAERSK	OWIK	25	39.3 N	61.0 W	00	31	35	5 NM	25	1000.0	16.2		10	10			
AMERICAN CHALLENGER	WHEP	25	13.7 N	73.3 W	12	04	35	10 NM	02	1011.2	30.0	29.4	4	10	09	9	13
SEALAND RACER	KSLB	25	39.1 N	60.2 W	18	29	N 39	10 NM	01	1010.5	17.8	18.9	5	5	29	< 6	8
AMERICAN AQUARIUS	WYOI	25	12.3 N	78.2 W	18	11	40	10 NM	01	1010.8	28.9	28.4	5	6.5	12	< 6	5
SAPPHIRE	KMYK	26	49.6 N	28.8 W	18	29	N 38	10 NM	02	1005.0	9.5	14.0	3	8	28	8	13
ADM WM M CALLAGHAN	KGYE	28	51.6 N	28.4 W	18	30	35	10 NM	02	1008.1	6.6	8.0	5	14.5	32	8	19.5
AMERICAN LEADER	KFEJ	28	52.2 N	34.7 W	18	31	40	5 NM	02	1005.0	6.6	10.0	8	10	29	13	26
AMERICAN LEADER	KFEJ	29	51.2 N	36.2 W	00	31	35	5 NM	02	1010.5	9.0	8.9	7	19.5			
AMERICAN ARGOSY	KFCX	29	49.7 N	28.1 W	18	33	40	5 NM	80	1001.8	11.7	12.8	6	16.5	32	8	23
AMERICAN ARGOSY	KFCX	30	49.3 N	30.2 W	00	34	35	5 NM	02	1006.0	11.7	12.8	6	14.5	34	8	23
GREAT LAKES VESSELS																	
CLIFFS VICTORY	9810	6	43.2 N	82.4 W	18	35	N 36	> 25 NM	08		6.8	8.8	6	6.5			
JOHN G MUNSON	9882	11	43.0 N	87.0 W	00	01	N 38	5 NM	61		3.8	3.8		10			
JOHN DYKSTRA	9652	11	44.5 N	82.8 W	12	04	N 37	10 NM	02		3.8	5.0		10			
CHARLES M BEEGHLY	9856	11	41.9 N	87.5 W	18	36	N 36	10 NM	01		1.8	7.8	4	10			
CALCITE II	9840	12	43.4 N	82.5 W	06	36	N 35	5 NM	61		3.8	6.0		6.5			
CASON J CALLAWAY	9841	16	47.5 N	87.9 W	06	04	N 36	10 NM	01		1.8	3.8	4	3			
LEON FRASER	9827	30	47.1 N	86.0 W	06	31	N 36	10 NM	00		2.0	6.0	11	6.5			
A H FERBERT	9801	30	47.2 N	86.6 W	08	33	N 43	> 25 NM	01		6.0	3.0	4	6.5			
ENVIRONMENTAL BUOYS																	
41001		04	34.7N	072.3W	03								5	16			
44004		03	39.0N	070.0W	13	34	M28			1004.2	7.1	8.9	3	08			
44005		23	42.7N	068.3W	15	03	M37			1008.5	6.2	8.3	3	09			

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves* Period sec.	Sea Waves* Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.*	Swell Waves Height ft.
NORTH ATLANTIC OCEAN		JUNE															
ESSO PALM BEACH	HPID	4	35.4 N	72.5 W	12	27	M 35	5 NM	54	1019.0	23.0						
AMAZONIA	MYO5906	6	34.2 N	76.5 W	12	09	M 35	10 NM		1010.1	24.4						
SEALAND RACER	KSLB	7	49.8 N	13.7 W	06	12	M 35	5 NM	62	0999.0	11.1	12.2	5	10	12	< 6	10
SEALAND MARKET	KJVG	7	47.2 N	29.6 W	12	27	38	10 NM	03	1017.8	15.6	11.7	6	13	27	10	13
DELAWARE SUN	KJQN	7	36.9 N	73.8 W	12	34	35	2 NM	81	1002.4	23.0	27.7	6	10	23	< 6	6.5
AMERICAN ACE	KFCV	8	50.3 N	15.8 W	18	32	35	5 NM	85	0990.0	12.7	12.2	6	16.5	28	8	10
SATSUMA	H3SI	9	47.9 N	10.7 W	00	23	35	5 NM	02	1005.0	12.7	12.0	6	14.5	23	8	14.5
RODRIGUES CARRILHO	CSDU	11	40.0 N	53.4 W	06	27	35	10 NM	02	0994.5	18.0	20.0	XX	19.5	25		19.5
AMERICAN ALLIANCE	KFFM	11	51.0 N	34.4 W	18	15	35	2 NM	10	0990.0	11.7	10.0	5	19.5	XX		
BALTIMORE TRADER	KASJ	12	18.3 N	83.0 W	00	12	35	2 NM	25	1011.0	25.6	26.7	3	5	12	6	10
AMERICAN ARCHER	KFCS	12	44.8 N	33.7 W	06	21	35	5 NM	03	0999.0	15.6	15.0	7	10	20	9	21
L.W. FUNKHOUSER	ABCZ	15	42.9 N	35.3 W	06	10	M 35	10 NM	02	1023.5	16.0	18.0	5	11.5			
DELAWARE SUN	KJQN	21	35.8 N	73.3 W	06	29	35	1 NM	99	1013.9	25.0	27.7	4	8	29	< 6	5
KNORR	KCEJ	25	40.6 N	13.1 W	06	36	M 35	10 NM	02	1014.5	17.8	20.0	4	14.5	36	7	13
KNORR	KCEJ	26	42.1 N	10.3 W	00	02	M 35	5 NM	01	1018.0	16.1	17.8	4	13	36	7	13
SEALAND GALLOWAY	KHLX	29	39.0 N	64.7 W	06	05	35	5 NM	02	1013.5	20.0	17.7	5	8	05	8	14
BALTIMORE TRADER	KASJ	29	25.7 N	74.5 W	18	05	35	10 NM	03	1017.0	27.8	26.7	3	5	05	< 6	6.5
BALTIMORE TRADER	KASJ	30	24.1 N	74.6 W	00	05	35	5 NM	03	1015.0	26.7	27.8	3	8	05	< 6	8
GREAT LAKES VESSELS																	
HOMER D WILLIAMS	9895	6	45.6 N	86.1 W	06	29	M 36	10 NM	04		16.0	3.0	2	5			
JOHN DYKSTRA	9852	8	44.6 N	82.9 W	12	21	M 35	10 NM	63		12.0	9.0	6	5			
PAUL H CARNAHAN	9884	18	47.6 N	88.0 W	18	27	M 32	10 NM	03		15.0	4.0	6	6.5			
GEORGE M HUMPHREY	9816	18	47.7 N	88.7 W	18	24	M 36	10 NM	02		10.0	5.0	5	6.5			
BENJAMIN F FAIRLESS	9803	19	47.3 N	88.2 W	00	26	M 37	10 NM	01		7.0	3.0	4	5			
HERBERT C JACKSON	9897	29	44.2 N	87.1 W	00	17	M 38	5 NM	02		16.0	11.0	3	8			
CALCITE II	9880	29	45.6 N	84.6 W	06	22	M 36	10 NM	18		21.0	14.0	5	5			
ENVIRONMENTAL BUOYS																	
42008		08	28.7N	095.3W	17	13	M35			1011.2	23.3	26.8					
42008		11	28.7N	095.3W	10	05	M42			1008.4	23.2	27.7					

\+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 28 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

Continued from page 414.

JUNE DATA SUMMARY 46012
AVERAGE LATITUDE 37.4N AVERAGE LONGITUDE 122.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	10.5	(25 15)	12.4	15.6	(08 18)	239	30
SEA TEMP (DEG C)	10.4	(15 12)	12.0	14.4	(06 21)	239	30
AIR-SEA TEMP (DEG C)	-01.6	(09 12)	00.4	02.6	(20 03)	239	30
PRESSURE (MBAR)	1008.9	(29 03)	1015.1	1022.5	(13 18)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-11	11-22	22-34	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	6.7	6.7				14.2	9.6
NE								
E								
SE	.4		.4				.8	8.5
S	1.7	5.9	2.1				9.6	6.9
SW	.4	1.3					1.7	4.8
W	.8	1.7	.4				2.9	5.6
NW	2.1	23.4	41.0	2.9			69.5	12.1
CALM	1.2						1.2	.0
TOTAL	7.5	38.9	50.6	2.9			100.0	10.8

NO. OF WAVE OBS: 238
SPEED: 27 KNOTS
DIRECTION: 320 DEG
DAY: 14
HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 238

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	.4	29.0	54.2	15.5	.8				2.1M	4.0M	(27 04)

JUNE DATA SUMMARY 46014
AVERAGE LATITUDE 39.2N AVERAGE LONGITUDE 124.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.5	(30 15)	12.3	16.5	(09 00)	239	30
SEA TEMP (DEG C)	08.3	(27 15)	10.4	13.6	(09 00)	239	30
AIR-SEA TEMP (DEG C)	-01.4	(30 15)	01.9	03.9	(19 03)	239	30
PRESSURE (MBAR)	1007.1	(28 06)	1015.6	1024.9	(13 21)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-11	11-22	22-34	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.1	12.1	22.6	.4			37.2	12.3
NE	.4						.4	3.0
E								
SE	.8	1.3					2.1	6.0
S	1.7	3.8	.8				6.3	5.9
SW		.4					.4	4.0
W								
NW	.8	5.3	29.3	16.0			51.5	19.0
CALM	2.1						2.1	.0
TOTAL	7.9	20.9	52.7	18.4			100.9	14.9

NO. OF WAVE OBS: 238
SPEED: 33 KNOTS
DIRECTION: 330 DEG
DAY: 27
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 238

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY			23.6	45.4	16.0	5.0			2.2M	5.0M	(28 00)

JUNE DATA SUMMARY 46013
AVERAGE LATITUDE 38.2N AVERAGE LONGITUDE 123.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.4	(24 10)	11.7	14.2	(19 03)	238	30
SEA TEMP (DEG C)	08.9	(23 12)	09.8	11.6	(20 00)	238	30
AIR-SEA TEMP (DEG C)	-01.1	(25 03)	02.0	05.3	(19 03)	238	30
PRESSURE (MBAR)	1009.5	(28 03)	1015.8	1024.6	(13 18)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-11	11-22	22-34	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8						.8	2.0
NE	.4						.4	2.0
E	.4	.4					1.3	4.4
SE	1.7	1.3	.8				3.8	5.0
S	2.5	.4					2.9	2.4
SW	.4	.4					.8	3.0
W	.4	4.2	8.0	1.3			13.9	13.7
NW	.8	3.4	17.6	51.7	1.7		74.8	23.2
CALM	1.3						1.3	.0
TOTAL	8.4	10.5	26.5	52.9	1.7		100.0	19.6

NO. OF WAVE OBS: 234
SPEED: 36 KNOTS
DIRECTION: 300 DEG
DAY: 27
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 234

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	.9	31.6	45.3	20.9	1.3				2.2M	4.0M	(27 09)

Selected Gale and Wave Observations, North Pacific

May and June 1981

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb	Temperatures °C		Sea Waves*			Swell Waves		
			Lat. deg.	Long. deg.		No.	Speed kt.				Air	Sea	Period sec.	Height ft.	No.	Period sec.*	Height ft.	
NORTH PACIFIC OCEAN		MAY																
GLACIER BAY	KACF	1	48.9 N	132.9 W	00	21	NE 40	5	NW	02	1003.5	10.6	7.7	3	10	21	7	13
THOMAS G THOMPSON	KGVT	1	55.1 N	167.2 W	00	24	N 37	5	NW	02	1012.4	5.5	4.3	5	10	24	7	10
MANULANI	KNTJ	1	22.2 N	156.2 W	00	05	NE 35	10	NW	02	1017.5	23.3	23.9	5	10	XX	10	16.5
BOGASARI DUA	PLYA	1	48.3 N	147.0 W	00	30	N 35	.5	NW	29	1002.5	8.2	7.8	4	19.5	34	>13	16
EXXON SAN FRANCISCO	KAFC	1	46.8 N	129.5 W	06	19	N 20	10	NW	03	1013.9	10.5	12.3	8	0	24	6	24.5
ARCO JUNEAU	KSPS	1	51.0 N	133.4 W	12	16	N 35	5	NW	02	0998.8	11.1	8.6			17	9	13
SEALAND DEFENDER	KGJB	1	49.5 N	133.2 W	18	25	W 38	5	NW	01	1001.0	10.0	9.0	6	10	25	8	19.5
AMERICA SUN	KWFJ	1	38.9 N	124.0 W	18	33	N 35	10	NW	02	1018.4	14.2	14.4	4	6.5	34	6	8
MANULANI	KNTJ	2	29.7 N	150.6 W	00	04	35	5	NW	03	1014.5	23.3	23.3	5	10	03	10	16.5
SEALAND DEVELOPER	KWRH	2	40.6 N	154.9 E	00	08	N 38	2	NW	47	1012.2	11.0	9.0	3	13	12	9	16.5
PRESIDENT JOHNSON	WVHS	2	41.8 N	154.5 E	00	09	28	2	NW	98	1016.0	7.8	6.7	10	10	14	8	32.5
ATLANTIC PIONEER	H3WN	2	49.8 N	134.7 W	12	27	N 37	2	NW	03	1008.0	6.0	10.0					
ATLANTIC PIONEER	H3WN	3	50.8 N	138.4 W	00	27	N 36	10	NW	03	1010.0	6.0	9.0	5	10			
EXXON NEW ORLEANS	WNDM	3	53.9 N	138.2 W	12	34	N 35	10	NW	02	1008.5	8.0	7.2	2	1.5			
PRESIDENT TAFT	WLDT	3	26.0 N	122.8 E	12	04	48	5	NW	02	1020.0	17.2	25.6	5	16.5	04	6	13
ANTARCTIC	3EJE	3	10.5 N	152.5 E	12	16	40	2	NW	81	1007.2	24.5	27.0					
MAUI	WSLH	4	32.8 N	121.6 W	12	32	N 40	10	NW	02	1013.0	13.3	16.1	3	6.5	02	6	10
PRESIDENT JOHNSON	WVHS	4	49.6 N	172.7 W	18	32	35	10	NW	01	1016.0	2.2	2.8	7	8	32	11	16.5
PRESIDENT TYLER	WEZM	4	39.2 N	145.5 E	18	34	N 38	5	NW	01	1013.2	10.0	6.1	3	8	27	10	11.5
PRESIDENT TRUMAN	WLPL	5	46.3 N	171.9 W	12	32	35	5	NW	24	1022.0	2.3	2.7	3	8	32	13	8
HAKUSAN MARU	JFZG	5	38.0 N	145.5 W	12	12	N 35	.25	NW	63	1009.0	13.5	11.5					
SEALAND ENDURANCE	KGJX	5	47.5 N	173.6 W	12	32	N 39	10	NW	71	1022.0	4.4	5.0	6	10	32	6	10
MANULANI	KNTJ	5	37.4 N	123.8 W	18	34	35	5	NW	00	1016.2	19.6	13.3	6	14.5	XX		
WISTERIA	WJPD	6	38.2 N	149.0 W	00	34	N 35	5	NW	25	1019.0	7.0	9.0	9	13	34	8	13
PRESIDENT TRUMAN	WLPL	6	46.3 N	167.1 W	00	36	35	10	NW	09	1015.9	6.7	5.0	3	8	36	13	16.5
QUEENS WAY BRIDGE	JMJE	6	41.7 N	167.4 W	06	36	N 35	10	NW	15	1015.0	6.5		4	8	34	7	10
PRESIDENT VAN BUREN	WAPI	6	48.2 N	172.0 W	06	01	37	10	NW	02	1021.2	5.4	3.1	6	10	34	9	16.5
PRESIDENT JOHNSON	WVHS	6	51.6 N	149.3 W	12	14	47	5	NW	02	1019.2	8.1	6.4	XX	24.5	XX		
ALEUTIAN DEVELOPER	WIPL	6	54.4 N	164.3 W	18	06	39	2	NW	21	1019.3	7.2	3.9	5	14.5	07	8	18
AMERICAN TRADER	KVKV	7	39.3 N	124.2 W	00	33	35	5	NW	02	1019.2	12.8	9.4	4	6.5	33	< 6	5
DIAMOND PHOENIX	DSPS	7	36.2 N	122.7 W	06	33	N 35	5	NW	05	1016.8	11.0	12.5	5	5	33	< 6	5
ORIENTAL TAIC	A8CV	7	50.0 N	164.3 W	06	09	N 40	5	NW	01	1005.0	7.0	9.2	6	11.5	08	6	11.5
MAUI	WSLH	7	32.5 N	123.2 W	12	33	N 35	10	NW	02	1015.8	12.2	14.4	4	6.5	33		10
VIENNA WOODS	SLOT	7	34.4 N	120.5 W	17	35	N 37	5	NW	05	1015.0	20.8	12.0	10	18	35	11	19.5
GLOBAL FRONTIER	H3AU	7	40.0 N	170.9 W	18	30	N 35	.5	NW	24	1011.5	9.8	9.0	10	21	31	9	21
SEALAND EXPLORER	WGJF	7	45.3 N	158.3 E	18	27	N 35	10	NW	02	0998.8	8.0	7.8	6	16.5	26	9	19.5
VIOLET	H8DF	7	51.2 N	157.1 W	18	07	N 38	1	NW	02	1005.5	15.0	6.4	6	8	08	7	11.5
VIOLET	H8DF	8	51.4 N	155.2 W	00	07	N 39	1	NW	02	1004.0	8.8	8.0	7	13	07	8	13
ORIENTAL EXPORTER	WRCH	8	34.9 N	144.7 E	06	33	N 39	> 25	NW	01	1008.0	16.5	19.0	5	13	32	10	13
GLOBAL FRONTIER	H3AU	8	40.8 N	174.4 W	06	31	N 36	200	YD	24	1008.7	10.8	9.0	12	21	32	8	16
SEATRAIN ORISKANY	DSOM	8	35.0 N	146.7 E	06	28	N 40	10	NW	01	1006.2	19.4	19.0	6	10	27		11.5
ORIENTAL TAIC	A8CV	8	49.8 N	158.8 W	06	10	N 35	1	NW	03	0992.0	6.0	10.0	6	13	09	7	18
PRESIDENT TAFT	WLDT	8	36.9 N	140.4 E	12	28	44	5	NW	02	1002.1	13.3	16.7	5	11.5	28	< 6	13
BLUE OCEAN	JKOH	8	45.3 N	152.6 E	18	10	N 35	5	NW	02	1014.5	6.0	2.0	4	6.5	10	6	8
SIENA	DXFU	8	50.6 N	165.6 W	23	03	N 38	5	NW	01	1004.8	7.2	9.0	3	10	03	6	13
SAN DIEGO	WSVR	9	51.3 N	134.1 W	00	20	35	5	NW	44	1010.2	8.9	6.7	10	13	20	12	16.5
AMERICA SUN	WNCJ	9	49.9 N	134.6 W	00	24	N 35	5	NW	81	1013.0	6.8	7.8	6	10	24	12	13
SEALAND ENDURANCE	KGJX	9	38.5 N	147.4 E	00	31	N 38	10	NW	02	1005.3	8.9	12.2	6	14.5			
SEATRAIN ORISKANY	DSOM	9	35.3 N	153.4 E	00	27	N 35	5	NW	02	1006.0	20.0	20.0	4	11.5	27		11.5
PACMONARCH	SMYA	9	44.1 N	154.5 E	00	07	N 50	2	NW	66	1012.0	8.0	9.0	5	6.5	09	7	13
PERENNIAL ACE	MGMQ	9	50.4 N	132.4 W	06	19	N 41	2	NW	03	1016.5	9.5	9.5			22		
OGDEN JORDAN	A8RZ	9	37.1 N	164.5 E	06	12	N 35	1	NW	63	1008.5	13.0	14.5	9	6.5	12	8	18
ANDERS MAERSK	OXIT	9	41.6 N	157.5 E	06	13	45	2	NW	61	1003.5	9.0	12.0	XX	16.5	XX		19.5
MANHATTAN	WJAF	9	51.3 N	136.3 W	12	23	35	5	NW	02	1014.7	10.0	8.9	4	10	21	8	13
CRESSIDA	3FTB	9	39.9 N	159.5 E	12	09	N 40	2	NW	06	0997.0	10.0	11.8	6	11.5	09	6	11.5
PRESIDENT TAFT	WLDT	9	43.1 N	160.1 E	18	11	40	5	NW	02	1012.0	7.2	6.1	4	6.5	11	6	13
EASTERN WORLD	ELVA	9	43.9 N	147.6 E	23	04	N 35	2	NW	58	1000.1	4.0	0.2	1	3	12	12	24.5
PACMONARCH	SMYA	10	44.6 N	161.8 E	00	06	N 37	5	NW	02	1016.5	9.0	5.0	5	6.5	04	8	16.5
PRESIDENT TAFT	WLDT	10	51.4 N	148.9 W	00	07	36	5	NW	02	1015.1	6.1	6.0	8	8	07	< 6	11.5
PERRYVILLE	KUTN	10	07.2 N	81.6 W	00	26	28	10	NW	60	1011.2	25.0	30.0	4	6.5	18	6	24
AMERICA MARU	JNXV	10	41.6 N	151.7 W	00	13	N 35	2	NW	63	1013.5	10.5	9.0	4	8	25	< 6	5
HIEI MARU	JDOC	10	43.6 N	154.9 W	00	16	N 37	.25	NW	66	1001.5	9.5	8.0	4	6.5	16	10	13
SIENA	DXFU	10	51.4 N	148.9 W	18	07	N 38	.25	NW	53	1008.0	7.4	6.0	6	13			
HOHSING BREEZE	3EOU	10	53.4 N	154.0 W	18	08	N 35	.5	NW	44	1002.9	7.0	6.0	6	19.5	08	6	19.5
MELLON WHEC 717	NDIY	10	39.0 N	124.4 W	23	34	N 40	2	NW	07	1016.7	13.9	15.0	8	13			
EXXON NEW ORLEANS	WNDM	11	37.3 N	123.8 W	00	34	N 40	5	NW	05	1015.9	13.0	12.8	3	8			
MELLON WHEC 717	NDIY	11	39.3 N	124.6 W	01	36	N 45	2	NW	07	1016.3	12.5	11.2	8	13			
TSU	LEVT	11	41.9 N	158.2 E	06	05	38	5	NW	07	1009.5	8.0	8.0	12	26			
MILLER FREEMAN	WTDM	11	56.6 N	151.9 W	06	10	N 35	5	NW	81	1009.0	7.5	7.4	XX	3	11	6	11.5
ARCO ANCHORAGE	WCIO	11	39.3 N	125.7 W	12	35	N 35	5	NW	07	1016.5	12.2	11.7	3	6.5	33	6	19.5
SANSINENA II	WSIN	11	40.6 N	125.3 W	12	36	35	10	NW	00	1020.0	11.1	11.1	6	18			
FEDTRADE	ABNF	11	34.2 N	127.0 W	18	38	N 35	10	NW	01	1018.0	16.0	16.0	7	8.5	38	10	16.5
SIENA	DXFU	11	50.1 N	137.5 W	23	15	N 35	2	NW	53	1013.2	9.7	6.0	8	5			
AMERICAN TRADER	WEZM	12	27.2 N	124.6 E	06	05	37	2	NW	61	1011.0	14.4	23.3	2	11.5	04	< 6	11.5
ATLANTIC PIONEER	H3WN	12	39.0 N	145.3 E	06	16	N 35	2	NW	25	1000.5	14.0	12.0	6	11.5			
SIMBA	OWFC	12	38.0 N	125.3 W	12	34	N 36	10	NW	02	1016.0	12.4	11.3	6	11.5			
PACIFIC ACE	H3YP	12	50.0 N	152.7 W	12	24	N 40	5	NW	02	1003.0	5.6	7.0	7	8	25	8	10
THOMPSON PASS	WSPY	12	37.7 N	123.7 W	18	34	40	5	NW	00	1011.5	11.5	10.1	2	6.5	34	< 6	6.5
MOBILOIL	WMTO	12	39.9 N	124.4 W	18	36	N 35	10	NW	00	1014.0	10.0	8.2	3	6.5	32	< 6	8
CRESSIDA	3FTB	12	34.8 N	141.6 E	18	16	N 36	2	NW	02	1003.0	18.0	13.8	7	13	16	7	13
MING GALAXY	BLHW	13	47.0 N	152.7 W	06	25	N 32	10	NW	03	1015.0	8.0	7.0	4	13	27	7	26
TONSINA	KJOG	13	59.9 N	145.6 W	06	11	22	5	NW	63	1011.2	8.9	5.6	5	5	17	10	24.5
LESLIE LYKES	WHTU	14	41.2 N	179.9 E	06	05	35	5	NW	80	1003.7	6.7	10.5	5	6.5	05	7	16.5
BLUE OCEAN	JKOH	14	50.7 N	160.3 W	18	08	N 35	5	NW	40	1006.5	5.5	4.5	2	5	08	< 6	6.5
MANULANI	KNTJ	15	22.3 N	156.1 W	00	10	N 38	10	NW	02	1018.0	25.6	24.4	4	8	11	10	13
AUSTRAL MOON	WEZT	16	33.1 N	119.0 W	18	28	42	10	NW	02	1009.5	13.9	10.0	10	19	28	12	21
AMERICAN TRADER	WEZM	17	35.3 N	149.9 E	12	04	35	10	NW	02	1011.5	16.7	20.6	2	8	04	6	10
QUEENS WAY BRIDGE	JMJE	17	47.4 N	149.8 W	18	31	N 36	2	NW	02	1011.5	8.5	8.0	3	10	32	8	18
QUEENS WAY BRIDGE	JMJE	19	50.2 N	158.6 E	00	22	N 45	2	NW	58	0993.0	8.0		4	10	22	7	13
PRESIDENT MADISON	WCIP	19	51.3 N	159.8 W	06	24	42	5	NW	02	0992.0	9.4	2.2	6	8	22	7	11.5
PRESIDENT TRUMAN	WLRL	19	54.0 N	162.0 W	12	20	45	5	NW	28	0988.1	5.5	4.7	3	13	20	13	16.5
CORNUCOPIA	KPJC	19	58.8 N	150.7 W	12	15	36	5	NW	52	1002.4	6.7	7.8	4	8	17	< 6	10
TOWNSEND CROMWELL	WTDF	19	23.3 N	163.8 W	18	09	N 50	10	NW	01	1018.4	26.4	24.4	2	3	26	8	8.5
DISCOVERER OSS	WTEA	19	56.1 N	166.6 W	18	21	N 40	5	NW	42	0997.5	4.7	5.4	5	23	XX		

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind			Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves?			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°		Speed kt.				Air	Sea	Period sec.	Height ft.		Dir. 10°	Period sec.*	Height ft.
NORTH PACIFIC OCEAN		JUNE																	
SHUNWIND	ELTQ	9	45.7	N 161.9 E	12	29	M	21	200 YD	65	1016.5	4.0	6.0	3	5		XX	10	65.5
KOFUKU MARU	JKL9	10	48.3	N 157.3 E	18	29	M	35	200 YD	44	1019.0	4.2	5.0	5	3		29	< 6	3
CHUEN ON	H3GX	12	35.5	N 122.0 W	19	32	M	45	> 25 NM	02	1018.0	18.5	12.0	5	8		32	< 6	8
CHUEN ON	H3GX	13	36.5	N 123.2 W	00	32	M	40	10 NM	02	1021.0	15.0	12.0	5	8		32	6	13
ORIENTAL EXECUTIVE	D5AN	13	43.3	N 150.4 W	00	14	M	35	2 NM	59	1007.0	12.0							
ASIA INDUSTRY	A8QI	13	44.4	N 151.3 W	00	11	M	40	2 NM	21	1009.0	11.0	10.0	9	10		11	9	13
PRESIDENT MADISON	WCIP	13	21.7	N 120.5 E	00	21		50	5 NM	21	0981.6	26.7	26.7	5	32.5		21	< 6	19.5
WALTER RICE	KCSE	13	34.9	N 121.6 W	06	32		45	5 NM	07	1017.8	15.6	11.1	5	13		31	9	26
EXXON NEW ORLEANS	WNDM	13	41.3	N 126.6 W	12	32	M	35	10 NM	25	1024.0	14.0	15.6	3	6.5				
PRESIDENT JEFFERSON	WPGE	13	46.1	N 165.0 E	18	13		46	2 NM	53	0999.0	9.4	5.4	5	6.5		13	7	13
CHAUVENET T AGS 29	NYCG	13	10.5	N 121.2 E	19	25	M	38	10 NM	97	1004.1	25.6	30.0	3	11.5		25	< 6	10
SEALAND DEFENDER	KGJB	13	48.7	N 143.5 W	18	12	M	35	2 NM	40	1009.0	11.0	11.0	4	10		12	8	16.5
SEALAND DEFENDER	KGJB	14	49.2	N 149.3 W	00	13	M	25	2 NM	00	0998.0	12.0	11.0	3	5		14	7	13.5
WALTER RICE	KCSE	14	37.5	N 123.5 W	00	32		40	5 NM	07	1023.0	15.0	9.4	5	13		31	9	19.5
LNG LEO	WDZB	14	32.2	N 136.1 E	00	06	M	45	10 NM	02	1005.3	21.5	21.7				10	06	6.5
PRESIDENT JEFFERSON	WPGE	14	46.9	N 167.9 E	00	11		40	2 NM	63	0999.1	8.9	5.6	5	6.5		12	7	10
MAUI	WSLH	14	32.6	N 122.8 W	00	34	M	45	10 NM	02	1019.3	17.2	17.2	5	10		34	7	14.5
HANJIN PCHANG	D8CN	14	51.3	N 144.5 W	00	09	M	50	2 NM	42	1009.0	10.0	12.0	7	13		09	< 6	11.5
CHUEN ON	H3GX	14	40.6	N 128.1 W	00	34	M	35	> 25 NM	02	1030.0	17.5	15.0	5	8		34	< 6	13
CRYSTAL STAR	D5TG	14	51.9	N 147.2 W	06	07	M	40	2 NM	53	1005.0	9.0	8.0	12	19.5		07	12	19.5
SINALOA	DXNS	14	50.2	N 145.6 W	12	25	M	46	5 NM	53	1006.1	9.2	9.0	7	16.5				
ARILD MAERSK	OXTH	14	45.9	N 174.2 E	18	13		35	2 NM	53	0999.4	7.5	3.0						
DIAMOND PHOENIX	D5WS	14	35.1	N 123.5 W	18	34	M	39	10 NM	03	1018.5	14.8	16.5	8	6.5		33	10	11.5
CRESSIDA	3FTB	14	50.4	N 142.1 W	18	20	M	38	2 NM	58	1013.0	9.0	9.8	6	14.5		20	6	14.5
ROSE	6ZCJ	14	33.9	N 122.8 W	18	35	M	38	10 NM	00	1018.7	14.2	13.0	7	14.5				
ROSE	6ZCJ	15	33.0	N 123.5 W	00	35	M	37	5 NM	05	1016.5	16.0	17.0	9	16.5				
PRESIDENT VAN BUREN	WWPI	15	49.0	N 144.8 W	00	23		40	5 NM	41	1011.6	8.9	7.8	5	6.5		14	8	10
ARILD MAERSK	OXTH	15	46.3	N 176.0 E	00	14		36	1 NM	64	1006.6	8.4	4.0	4	13				
WALTER RICE	KCSE	15	42.0	N 124.7 W	00	32		35	5 NM	02	1026.1	14.0	14.4	3	6.5		32	7	13
CRYSTAL STAR	D5TG	15	51.4	N 139.0 W	06	18	M	39	5 NM	02	1009.0	8.0	9.0	10	16.5		18	12	19.5
CRESSIDA	3FTB	15	51.6	N 147.4 W	12	28	M	37	2 NM	05	1012.0	9.0	11.0	6	14.5		28	6	14.5
WESTERN HIGHWAY	3FTF	15	47.9	N 140.9 W	18	25	M	35	5 NM	15	1015.7	10.0	9.0	5	6.5		25	10	14.5
OCEAN LOC	8JLF	15	31.0	N 125.9 W	18	36	M	36	> 25 NM	01	1016.0	18.0	20.0	4	14.5		36	6	13
CHUEN ON	H3GX	15	46.4	N 139.1 W	18	10		40	5 NM	50	1019.0	11.0	10.0	5	10		23	8	18
PRESIDENT TRUMAN	WLPL	15	45.9	N 178.5 E	18	11		48	5 NM	02	1003.0	6.7	5.5	4	8		11	>13	24.5
CHUEN ON	H3GX	16	47.6	N 140.7 W	00	26	M	40	5 NM	02	1019.0	11.0	9.0	5	13		27	8	23
PACIFIC VENTURE	HOVS	16	43.9	N 179.7 W	00	09	M	30	2 NM	16	1000.0	13.0	6.0	7	16		09	10	24.5
OCEAN LOC	8JLF	16	31.6	N 124.2 W	00	02	M	35	> 25 NM	01	1015.0	19.0	17.0	4	14.5		02	7	13
MAINE ORE	6ZPT	16	44.5	N 166.0 W	00	09		35	2 NM	07	1004.0	9.4	7.0	7	11.5		09	10	14.5
ARILD MAERSK	OXTH	16	46.8	N 167.8 W	06	09		40	2 NM	02	1000.8	7.6	5.0						
JAPAN ACE	JKFS	16	43.5	N 159.8 W	06	12	M	37	2 NM	63	1007.0	9.0	9.0	3	8		13	6	11.5
PRESIDENT TRUMAN	WLPL	16	44.4	N 174.5 W	12	05		50	5 NM	02	1000.0	7.3	5.5	4	11.5		05	10	26
TOYOTA MARU 12	J8J0	16	45.7	N 151.0 W	18	16	M	40	5 NM	63	1011.2	10.5	11.0	6	6.5		16	9	13
TOYOTA MARU 12	J8J0	17	43.6	N 149.1 W	00	19	M	38	2 NM	53	1010.0	12.0	11.0	6	6.5		17	8	13
PRESIDENT TRUMAN	WLPL	17	46.4	N 171.3 W	00	05		40	5 NM	02	0993.7	9.5	5.6	5	11.5		11	>13	29.5
MATSONIA	KHPC	17	37.2	N 124.3 W	18	36		35	5 NM	05	1019.0	15.6	14.4	3	6.5		36	7	13
MILLER FREEMAN	WTDM	17	49.9	N 149.9 W	18	11	M	35	5 NM	02	1000.0	8.0	8.6	2	5		11	< 6	16.5
CHUEN ON	H3GX	17	52.1	N 174.5 W	18	09	M	35	2 NM	02	1002.0	8.0	8.0	5	11.5		09	8	23
VAN CONQUEROR	A8IB	17	51.5	N 150.8 W	18	09	M	36	2 NM	02	1003.0	7.0	12.0						
VAN CONQUEROR	A8IB	18	51.7	N 149.5 W	00	09	M	40	2 NM	02	1002.0	8.0	12.0						
ORIENTAL TAIO	A8CV	18	39.5	N 148.5 E	00	10	M	35	2 NM	02	1007.0	14.0	15.0	4	6.5		11	< 6	6.5
CHUEN ON	H3GX	18	52.6	N 156.7 W	00	10	M	35	2 NM	02	1001.0	9.0	8.0	6	13		10	8	23
PRESIDENT JEFFERSON	WPGE	18	50.5	N 137.2 W	06	12		35	5 NM	63	1002.6	10.6	9.4	7	6.5		12	8	10
MOBIL ARCTIC	KSPY	18	51.8	N 132.1 W	12	09	M	55	2 NM	51	1000.0	10.0	9.6	4	6.5		14	6	13
PACIFIC VENTURE	HOVS	18	45.1	N 156.6 W	12	25	M	35	2 NM	40	1004.9	9.0	6.0	6	14.5		25	8	19.5
EURO-ASIA CONCORDE	A8YN	18	39.1	N 151.2 E	23	19	M	40	.5 NM	10	0999.5	16.0	11.0	4	8		19	7	13
ORIENTAL TAIO	A8CV	19	42.4	N 154.5 E	00	08	M	35	5 NM	01	1011.0	10.0	7.0	4	8		08	< 6	6.5
PACBARONESS	5LFX	19	35.7	N 145.2 E	00	36	M	39	1 NM	02	1006.0	17.0	20.0	9	14.5		36	9	16.5
MAUI	WSLH	19	32.4	N 123.6 W	00	35	M	35	10 NM	02	1012.4	17.8	15.6	4	6.5		34	8	11.5
MOBIL ARCTIC	KSPY	19	50.8	N 130.2 W	06	25		35	2 NM	51	1006.1	9.0	11.2	5	8		25	7	6.5
PRESIDENT GRANT	WEZD	19	38.2	N 151.5 E	18	01	M	35	5 NM	09	0997.5	13.3	13.3	5	14.5		05	11	16.5
DIAMOND PHOENIX	D5WS	19	38.2	N 166.4 W	18	20	M	35	.25 NM	98	1018.5	16.0	14.5						
EURO-ASIA CONCORDE	A8YN	19	40.6	N 154.5 E	23	01	M	40	.25 NM	45	1005.5	11.0	11.0	6	16.5		01	6	23
PRESIDENT FILLMORE	WRDH	20	40.8	N 152.4 E	06	06		35	200 YD	45	1004.0	10.0	10.6	6	10		06	7	24.5
EURO-ASIA CONCORDE	A8YN	20	41.0	N 157.0 E	17	09	M	40	.25 NM	65	1005.5	9.5	10.0	6	16.5		09	6	16.5
UNIVERSAL WING	8KVF	20	43.2	N 152.6 W	18	23	M	40	5 NM	02	1012.0	12.0	9.5	5	8		21	10	13
CHUEN ON	H3GX	20	53.3	N 174.3 E	23	27	M	35	5 NM	40	1019.0	7.5	6.0	5	10		27	7	13
PACBARONESS	5LFX	21	41.1	N 151.0 E	00	02	M	36	5 NM	21	1006.5	12.0	15.0	8	14.5		02	8	16.5
AUSTRAL ENDURANCE	KIRF	21	36.9	N 125.5 W	00	35		35	10 NM	02	1018.6	16.1	13.9	3	14.5		35	< 6	24.5
EURO-ASIA CONCORDE	A8YN	21	41.8	N 159.5 E	05	09	M	38	200 YD	45	1010.0	10.0	10.0	5	16.5		09	< 6	16.5
LNG TAURUS	WDZW	21	25.5	N 125.8 E	06	17	M	42	5 NM	07	1007.5	28.0	26.7	XX	10		XX		19.5
ARCO JUNEAU	KSRC	21	39.3	N 124.7 W	06	36	M	42	10 NM	02	1018.2	15.5	8.3	5	16.5		34	>13	18
SEALAND FINANCE	WJMG	22	46.4	N 136.8 W	00	25		35	5 NM	40	1012.0	11.1	10.0	5	13		26	8	19.5
PERENNIAL ACE	HOPQ	23	44.7	N 153.0 E	21	13	M	36	1 NM	63	1002.5	7.0	4.5	30	3		13	< 6	8
AMERICA SUN	WNEJ	24	38.9	N 124.4 W	18	33	M	35	5 NM	00	1013.0	17.0	11.1	3	5		34	6	6.5
HANJIN PCHANG	D8QN	25	43.6	N 134.4 W	00	26	M	41	10 NM	02	1022.0	14.0	16.0	6	8		26	< 6	6.5
AMERICA SUN	WNEJ	25	41.1	N 126.5 W	06	35	M	35	5 NM	03	1021.0	15.2	14.4	3	6.5		35	6	6.5
SINALOA	DXNS	25	28.3	N 123.2 E	12	19	M	36	5 NM	03	1009.0	26.0	16.0						
DAWN	WLDP	26	38.4	N 124.5 W	06	32		35	5 NM	02	1014.2	13.4	11.1	5	6.5		34	6	13
AMERICAN CHIEFTAIN	WJVA	26	42.0	N 167.2 W	12	09		35	1 NM	63	1003.0	11.1	12.2	3	8		10	7	13
DAVID STARR JORDAN	WTDK	26	37.0	N 124.9 W	23	34	M	40	10 NM	01	1014.5	15.1	16.0	XX	5		34	6	19.5
EXXON NEW ORLEANS	WNDM	27	41.7	N 126.9 W	00	34	M	38	5 NM	02	1026.1	16.2	16.1	3	6.5		34	6	10
PRESIDENT TRUMAN	WLPL	27	39.0	N 125.7 W	00	35		50	5 NM	02	1020.3	16.6	15.6	6	10		32	8	10
SKOUBORO	LIQN	27	42.6	N 158.3 W	00	17		35	.5 NM	63	1015.0	12.5		5	10		17	10	13
TOYOTA MARU 12	J8J0	27	44.5	N 158.3 W	00	15	M	35	.5 NM	51	1013.0	10.0	10.0	7	10				
PACBARONESS	5LFX	27	46.5	N 143.1 W	00	08	M	36	2 NM	61	1005.0	9.0	9.0	7	10		08	10	13
QUEENS WAY BRIDGE	JMJE	27	39.5	N 127.5 W	06	35	M	42	5 NM	02	1024.0	14.7							
MAUI	WSLH	27	30.4	N 132.8 W	06	01	M	40	10 NM	03	1026.0	18.9	20.0	6	11.5		01	7	11.5
KAUAI	WSHN	27	36.6	N 126.6 W	12	32		30	10 NM	03	1016.8	13.3	15.6		16.5		34		24.5
DAWN	WLDP	27	39.0	N 125.4 W	12	33		37	5 NM	02	1014.0	14.1	12.7	4	10		33	6	14.5
MALLORY LYKES	WLPN	27	36.7	N 125.8 W	12	34		40	10 NM	02	1016.3	13.3	13.3	5	19.5		34	8	16.5
DAVID STARR JORDAN	WTDK	27	37.0	N 124.7 W	14	35	M	42	5 NM	02	1012.9	15.0		XX	5		34	9	19.5
DITTE SKOU	OWJG	27	38.5	N 129.3 W	18	02		35	10 NM	02	1026.0	17.9	14.0	10	24.5				
PRESIDENT GRANT	WEZD	27	38.5	N 127.0 W	18	36	M	45	5 NM	07	1019.8	15.6	14.4	7	19.5		01	12	16.8

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind			Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C.		Sea Waves			Swell Waves		
			Lat. deg.	Long. deg.		Dir.	Speed kt.					Air	Sea	Period sec.	Height ft.	Dir.	Period sec.	Height ft.
NORTH PACIFIC OCEAN		MAY																	
SINALOA	OXNS	19	48.6 N	176.5 W	23	27	N	38	5 NM	01	1000.2	8.7	5.7	5	8	27	9	14.5
ARILD MAERSK	OXTN	20	52.2 N	153.5 W	00	25		26	> 25 NM	03	1000.0	7.0	4.8	8	16.5	24	8	20.5
DISCOVERER OSS	WTFA	20	55.9 N	166.6 W	00	19	N	26	5 NM	50	0976.5	5.4	5.2	6	19.5	XX		
CORAL ACE	3EPA	20	42.1 N	167.8 E	00	11	N	37	200 YD	45	1000.8	7.8	4.8	3	5	11	12	11.5
PRESIDENT TRUMAN	WLPL	20	54.1 N	169.5 W	06	25		50	5 NM	02	0978.8	4.4	4.5	5	10	26	12	26 -
CORNUCOPIA	KPJC	20	55.6 N	143.8 W	06	18		35	2 NM	63	1002.0	6.7	7.3	5	8	16	7	10
QUEENS WAY BRIDGE	JMJE	20	51.0 N	172.6 W	06	26	N	38	5 NM	15	0989.5	3.5		4	10	26	8	13
SEALAND FINANCE	WJFG	20	52.5 N	168.5 W	12	23		35	5 NM	02	0986.0	5.6	6.1	6	6.5	23	8	13
SEALAND FINANCE	WJFG	21	51.5 N	176.0 W	00	25		36	10 NM	02	0990.5	7.2	3.3	6	6.5	25	6	10
TRAVIATA	SFPZ	21	54.5 N	171.5 W	06	25		30	5 NM	25	0985.0	7.0	6.0	6	13	25	10	26
SINALOA	OXNS	22	51.5 N	151.2 W	12	10	N	36	5 NM	54	0998.8	6.7	7.0	6	10			
GREAT OCEAN	JKJT	22	43.0 N	143.4 W	12	14	N	35	2 NM	28	1015.0	11.5	10.0	4	6.5	14	< 6	6.5
KOFUKU MARU	JKLB	22	49.3 N	142.5 W	12	14	N	37	5 NM	03	1007.9	9.5	9.0	6	10	16	6	10
TOYOTA MARU 12	JBJO	22	31.4 N	131.7 W	15	02	N	09	10 NM	02	1024.0	16.0	18.0	2	32.5	02	6	3
PACIFIC VENTURE	HOVS	22	45.3 N	163.2 W	18	29	N	26	5 NM	40	0996.5	8.0	4.0	9	24.5	17	8	24.5
PACIFIC VENTURE	HOVS	23	45.2 N	160.7 W	00	30	N	35	5 NM	02	0998.2	11.0	5.0	9	19.5	30	12	26
SINALOA	OXNS	23	51.6 N	146.6 W	00	10	N	41	1 NM	10	0997.9	6.7	7.7	10	16.5			
GREAT OCEAN	JKJT	23	42.9 N	150.5 W	12	23	N	40	2 NM	02	1005.0	10.0	10.5	5	10	23	< 6	10
GREAT OCEAN	JKJT	24	42.4 N	155.0 W	06	23	N	38	2 NM	02	1014.0	9.0	10.0	5	11.5	23	< 6	11.5
OVERSEAS MARILYN	WFOB	24	35.7 N	121.8 W	06	32	N	35	2 NM	07	1011.5	14.5	13.0	3	10	31	6	8
PRESIDENT TYLER	WEZM	24	42.1 N	171.9 E	18	31	N	36	5 NM	21	1006.0	5.0	7.2	8	26			
SEALAND LIBERATOR	KHPP	24	39.9 N	172.5 E	18	30	N	40	10 NM	03	1009.0	9.0	11.0	10	21			
STREAM BOLLARD	ELYM	24	42.7 N	177.6 E	18	27	N	35	10 NM	15	0998.0	9.0	6.0	6	10	27	7	13
PRESIDENT TRUMAN	WLPL	25	39.7 N	146.4 E	00	15		40	2 NM	03	0991.1	14.4	6.1	2	6.5	15	< 6	10
PRESIDENT TYLER	WEZM	25	42.2 N	177.0 E	06	31	N	35	5 NM	16	1002.1	7.2	6.1	10	32.5	30	13	46
IRIS ISLAND	JPKS	25	41.5 N	150.0 E	06	16	N	40	.5 NM	28	0994.0	11.0	9.0					
STREAM BOLLARD	ELYM	25	42.2 N	179.0 W	06	27	N	38	5 NM	52	0998.0	8.5	9.0	6	10	27	8	13
CRESSIDA	3FTB	25	40.6 N	178.1 E	06	29	N	45	2 NM	43	1005.0	11.0	11.2	6	19.5	29	6	19.5
GREAT OCEAN	JKJT	25	41.0 N	164.8 W	12	21	N	40	2 NM	44	1002.0	12.0	10.0	4	6.5	21	< 6	6.5
CHARLES LYKES	KLMB	25	36.0 N	179.7 W	12	29		40	10 NM	01	1010.2	12.2	12.8	7	19.5			
PRESIDENT TAFT	WLOT	25	41.6 N	148.6 E	12	14		54	5 NM	61	0996.0	8.9	3.9	4	8	14	< 6	16.5
GOLDEN PHOENIX	3EYN	25	46.1 N	171.6 W	18	29	N	39	10 NM	80	1005.0	12.5	15.5	3	10	29	6	11.5
ORIENTAL COMMANDER	6ZWU	25	38.4 N	173.2 W	18	27	N	35	5 NM	80	1002.0	11.0	11.0	5	5	27	10	19.5
ORIENTAL COMMANDER	6ZWU	26	38.0 N	174.7 W	00	31	N	37	5 NM	02	1007.0	13.0	13.0	8	8	28	>13	19.5
ROSE	6ZFJ	26	38.2 N	180.5 E	00	17	N	35	10 NM	02	1017.7	14.0	13.0	6	10			
GOLDEN PHOENIX	3EYN	26	35.9 N	172.9 W	00	30	N	40	10 NM	01	1006.5	13.0	15.5	3	11.5	29	6	13
CRESSIDA	3FTB	26	40.3 N	176.8 W	00	30	N	44	5 NM	05	1008.0	12.0	13.2	6	19.5	30	6	19.5
STREAM BOLLARD	ELYM	26	41.3 N	173.4 W	00	30	N	37	5 NM	80	0997.0	7.0	11.0	6	10	30	8	13
PRESIDENT TAFT	WLOT	26	39.1 N	145.4 E	00	25		45	5 NM	01	0999.9	13.3	11.7	4	8	21	6	13
PRESIDENT TYLER	WEZM	26	41.7 N	175.5 W	00	32	N	45	2 NM	02	1000.5	9.4	7.8	9	19.5	30	12	32.5
PRESIDENT FILLMORE	WRDH	26	51.8 N	165.8 W	05	06		35	.25 NM	47	0999.0	5.6	5.6	4	8	06	7	11.5
VAN HAWK	OS7U	26	45.7 N	157.4 W	06	12	N	35	2 NM	63	0999.0	8.5	4.0	8	6.5	12	12	19.5
THOMAS WASHINGTON	KSWU	26	39.2 N	151.5 E	12	29	N	50	2 NM	02	1003.0	11.7	13.7	NX	13	26	10	13
GREAT OCEAN	JKJT	26	40.0 N	170.0 W	12	27	N	50	2 NM	03	1001.0	9.0	11.0	8	13	27	8	13
WASHINGTON WOOD	JEOV	26	50.2 N	150.6 W	12	12	N	40	10 NM	03	1010.0	6.5	6.0	5	8	12	< 6	8
SEPTA	A8JO	26	40.6 N	150.6 E	18	32	N	40	2 NM	02	1003.0	5.5	8.0	4	11.5	32	13	23
VAN TRIUMPH	6ZJP	26	42.4 N	159.0 E	18	25	N	35	10 NM	03	0994.0	7.5	8.0					
GREAT OCEAN	JKJT	27	39.5 N	171.9 W	00	27	N	35	5 NM	02	1013.0	9.0	11.0	8	13	27	8	13
CORNUCOPIA	KPJC	27	41.4 N	134.8 W	06	29	N	36	10 NM	03	1015.4	13.4	14.0	5	8	01	< 6	8
PRESIDENT TYLER	WEZM	27	41.7 N	165.0 W	06	29	N	20	5 NM	52	0991.5	8.9	7.8	4	10	27	13	24.5
CRESSIDA	3FTB	27	39.6 N	168.3 W	06	30	N	43	5 NM	05	1007.0	13.0	8.1	7	19.5	30	7	19.5
STREAM BOLLARD	ELYM	27	40.1 N	164.5 W	06	28	N	37	5 NM	81	0999.5	10.0	11.0	7	13	28	9	14.5
WASHINGTON WOOD	JEOV	27	46.8 N	167.7 W	12	11	N	45	5 NM	63	1002.0	8.0	7.0	5	6.5	11	< 6	10
ROSE CITY	WGJP	27	37.1 N	157.9 W	18	27		35	5 NM	21	1003.8	12.7	7.8	6	6.5	28	10	14.5
EXXON NEW ORLEANS	WNRM	29	34.4 N	121.2 W	00	32	N	40	5 NM	05	1012.5	14.5	12.2	2	6.5			
WASHINGTON WOOD	JEOV	28	47.4 N	136.3 W	06	14	N	40	5 NM	63	1005.0	11.4	9.1	5	6.5	14	< 6	6.5
TOYOTA MARU 12	JBJO	28	42.9 N	146.1 W	15	21	N	35	5 NM	03	0995.5	9.5	10.0	5	6.5	25	10	16.5
PHILIPPINE CORREGIDOR	DZPS	28	33.0 N	148.7 E	18	14	N	40	1 NM	02	1000.3	17.0	25.0	6	6.5	14	6	5
PRESIDENT PIERCE	WUPV	28	38.9 N	147.0 E	18	16		35	5 NM	52	1001.8	14.4	12.8	3	5	16	7	11.5
SAMUEL S	5LMX	29	39.5 N	149.8 E	00	14	N	50	2 NM	60	1000.0	13.0	13.0	8	13	14	8	19.5
PHILIPPINE CORREGIDOR	DZPS	29	31.3 N	150.3 E	00	19	N	38	1 NM	40	1000.3	21.0	26.0	6	6.5	19	< 6	5
TOYOTA MARU 12	JBJO	29	43.4 N	148.3 W	00	28	N	36	2 NM	02	1002.5	10.0	10.5	6	8	27	8	14.5
SEALAND DEFENDER	KGJB	29	38.4 N	146.7 W	00	17	N	35	5 NM	61	0993.0	16.5	20.0	5	13	17	9	16.5
PRESIDENT PIERCE	WUPV	29	40.9 N	151.2 E	06	11		40	1 NM	45	0997.8	12.2	12.2	7	16.5	11	9	16.5
ORIENTAL COMMANDER	6ZWU	29	35.1 N	152.5 E	18	26	N	35	2 NM	03	0999.0	20.5	17.0	7	8	21	8	16.5
ORIENTAL TAIC	A8CV	29	45.7 N	154.9 E	18	15	N	35	1 NM	18	1006.0	4.0	6.0	6	11.5	15	6	11.5
THOMAS WASHINGTON	KSWU	29	43.5 N	158.1 E	18	11	N	40	2 NM	02	0997.0	6.1	7.8	4	16.5	12	6	23
THOMAS WASHINGTON	KSWU	30	43.9 N	159.5 E	00	10	N	45	1 NM	21	0992.5	7.5	7.7	4	16.5	11	8	20.5
GOLDEN PHOENIX	3EYN	30	32.9 N	156.5 E	00	22	N	35	.25 NM	18	1007.0	22.0	22.0	4	6.5	22	7	10
CHEVRON WASHINGTON	KFDB	30	35.4 N	121.8 W	06	32	N	38	10 NM	02	1013.9	12.8		2	6	31	6	13
GREAT OCEAN	JKJT	30	35.1 N	166.9 E	06	19	N	39	.25 NM	11	1012.0	19.0	17.0	5	6	18	< 6	8
SAMUEL S	5LMX	31	43.1 N	160.6 E	00	27	N	40	.5 NM	21	0997.0	10.0	7.0	5	8	27	6	8
ORIENTAL TAIC	A8CV	31	42.5 N	150.0 E	00	30	N	35	5 NM	02	0998.0	7.0	6.0	5	11.5	30	6	11.5
AMERICAN APOLLO	KCOD	31	35.8 N	129.7 E	06	30		25	10 NM	01	1023.5	15.0	13.0			31	13	26.5
ATLANTIC PIONEER	H3WN	31	48.9 N	139.9 W	12	19	N	35	1 NM	03	1004.5	11.0	9.0	5	8			
VAN HAWK	OS7U	31	42.5 N	163.9 E	18	26	N	38	2 NM	52	1002.0	7.5	4.0	8	6.5	26	>13	26
AMERICA SUN	WNFJ	31	54.5 N	140.1 W	18	14	N	37	2 NM	61	1004.5	13.0	8.9	5	6.5	14	< 6	10
ARCO PRESTIGE	WLOU	31	36.3 N	125.7 W	18	33		36	10 NM	02	1016.5	16.7	12.8	7	10	34	7	8
ARCO ALASKA	WSPK	31	53.9 N	138.7 W	20	13	N	38	5 NM	81	1007.0	7.8	8.9	6	19.5	15	6	16.5
		JUNE																
ARCO ANCHORAGE	WCIO	1	53.7 N	138.0 W	00	15	N	36	5 NM	48	1009.5	9.4	10.0	7	10			
ARCO PRESTIGE	WLOU	1	39.6 N	124.8 W	00	34		35	10 NM	02	1015.0	15.0	13.3	5	8	34	7	13
VAN HAWK	OS2U	1	42.1 N	163.0 E	00	26	N	38	5 NM	01	1006.0	11.0	9.0					
SAMUEL S	5LMX	1	44.7 N	167.5 E	00	29	N	35	5 NM	21	0998.0	6.0	5.0	7	10	29	7	10
PRESIDENT PIERCE	WUPV	1	46.5 N	173.3 W	12	24		37	2 NM	03	0992.2	6.7	4.4	3	11.5	29	7	16.5
VAN TRIUMPH	6ZJP	2	46.8 N	145.5 W	00	16	N	35	.5 NM	53	0994.0	9.0	9.0					
SEALAND MARINER	KGJF	2	39.5 N	145.9 E	12	27	N	35	5 NM	02	1005.0	9.5	5.0	5	10	27	>13	19.5
PHILADELPHIA	WJGO	3	57.6 N	145.8 W	00	11	N	35	5 NM	02	0990.9	7.8	9.4	5	5	11	< 6	6.5
THOMPSON PASS	WSPY	3	58.2 N	143.0 W	06	13		35	5 NM	10	0992.0	9.8	9.8	2	14.5	13	12	14.5
FAIRWEATHER	WTFB	4	57.9 N	149.1 W	06	11	N	20	10 NM	03	0993.1	8.9	8.9	2	24.5	13	7	3
PRESIDENT GARCIA	DVEL	6	44.3 N	163.5 W	00	15	N	35	2 NM	80	1000.5	9.0	- 1.0	6	5	14	6	5
GLACIER BAY	WACF	6	47.3 N	131.9 W	00	23		35	10 NM	03	1006.2	10.0	11.7	6	13	22	7	14.5
EASTERN DIAMOND	WDFT	6	51.7 N	134.1 W	17	23	N	35	> 25 NM	03	1006.9	12.9	10.0	6	5	26	6	5

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind			Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves?		Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°		Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.°	Height ft.
NORTH PACIFIC OCEAN		JUNE																
BLUE OCEAN	JKOH	27	47.7 N	167.7 E	18	08	M	35	.25	NM	83	1015.0	7.0	5.0	2	5	08	< 6	5
WESER EXPRESS	DLOE	27	38.4 N	178.9 W	18	36		37	10	NM	02	1024.0	16.0	15.8	5	10	02		13
PRESIDENT GRANT	WEZD	28	36.2 N	174.9 W	00	35	M	35	5	NM	01	0998.9	15.6	13.9	7	19.5	35	12	16.5
ADRIAN MAERSK	OYIT	28	39.1 N	125.6 W	00	35		41	2	NM	06	1011.3	19.2			23	35		26
DAWN	WLOP	28	39.9 N	125.8 W	00	33		40	10	NM	02	1014.0	16.2	15.6	4	13	34	6	16.5
DITTE SKOU	OWJS	28	36.5 N	128.3 W	06	01		45	10	NM	02	1020.0	17.8	16.0	12	28			
MAKUSAN MARU	JF7S	28	39.1 N	126.9 W	12	36	M	40	10	NM	02	1014.1	14.0	13.5	6	13	01	10	26
GOLDEN PHOENIX	JEYH	28	37.5 N	125.5 W	12	35	M	35	10	NM	00	1010.0	13.0	18.0	7	10	31	7	10
EXXON BATON ROUGE	WAFA	28	40.9 N	127.3 W	18	01		35	> 25	NM	00	1018.1	16.0	13.3	6	10			
PRESIDENT TRUMAN	WLRL	29	46.1 N	149.7 W	00	27		35	< 50	YD	20	1020.0	11.3	10.0	5	8	27	6	8
LOMPOC	KOPL	29	49.4 N	136.1 W	00	26		40	10	NM	02	1009.1	11.2	11.2	XX	10	26	8	18
FRIENDSHIP	ELXP	29	50.7 N	137.2 W	00	25	M	35	5	NM	58	1004.0	11.0	13.0	3	19.5			
PRESIDENT FILLMORE	KRDH	29	51.8 N	132.5 W	12	25		35	10	NM	00	1003.2	11.1	11.7	5	3	29	6	8
LIONS GATE BRIDGE	JCLL	29	49.7 N	135.6 W	12	27	M	35	2	NM	21	1010.7	11.5		5	10	25	8	16.5
PHILADELPHIA	WJGO	29	53.1 N	134.0 W	12	27	M	35	5	NM	02	1000.0	11.7	12.8	5	5	27	< 6	13
BLUE OCEAN	JKOH	29	49.7 N	177.3 W	18	07	M	35	5	NM	81	1014.5	8.0	8.0	5	6.5	07	< 6	8
PRESIDENT FILLMORE	KRDH	30	53.8 N	138.1 W	00	30		35	10	NM	01	1002.8	12.2	11.1	5	5	26	9	6.5
SEALAND LIBERATOR	KHRP	30	36.0 N	148.9 E	06	04	M	35	2	NM	02	1004.5	17.0	15.0	9	8	08	11	10
BLUE OCEAN	JKOH	30	50.2 N	169.5 W	18	06	M	35	5	NM	11	1004.0	8.0	7.0	4	8	06	6	8
PERENNIAL ACE	HOMQ	30	37.5 N	157.0 E	21	06	M	40	5	NM	21	1004.0	17.0	17.0	4	6.5	08	6	10
NORTH PACIFIC Ocean ENVIRONMENTAL BUOYS																			
46013		18	38.2N	123.3W	21	30		M36				1014.1	13.0	9.2	2	06			
46013		27	38.2N	123.3W	00	30		M36				1012.5	11.9	9.1	3	08			

\+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

WE OF NOAA ARE MAKING USE OF THIS SMALL AMOUNT OF SPACE TO EXTEND OUR THANKS TO ALL THE SHIPS' OFFICERS WHO ROUTINELY TAKE SHIPBOARD WEATHER OBSERVATIONS. TO US, THESE EXCELLENT OBSERVATIONS ARE PRICELESS. WE CERTAINLY DO APPRECIATE RECEIVING THEM REGULARLY.

U.S. Cooperative Ship Weather Reports

May and June 1981

SHIP NAME	VIA RADIO	VIA MAIL
ACE ENTERPRISE	1	
ADM W M CALLAGHAN	29	114
AFRICAN STARS	5	38
ALABAMA	47	78
ALLISON LYKES	12	
ALVA MAERSK	21	
AMERICAN ACCORD	29	100
AMERICAN AQUARIUS	28	86
AMERICAN ASTRONAUT	69	167
AMERICAN CHIEFTAIN	51	164
AMERICAN HIGHWAY	13	
AMERICAN LEGACY	59	127
AMERICAN LYNX	P	110
AMERICAN TRADER	76	207
AMOCO VOYAGER		81
ANITA THYSSEN	1	
AQUARIUS	2	
ARCO FAIRBANKS	69	70
ARCTIC TOKYO		149
ARILD MAERSK	20	87
ASIA BEAUTY	12	
ASIA HONESTY	29	34
ATLANTIC PIONEER	29	139
AUSTRAL ENTENTE	13	32
AUSTRAL PIONEER	48	60
AXEL MAERSK	20	17
BALS BUTTE	18	109
BARRIER TOBA	18	25
BAYAMON	6	
BERKSHIRE	112	
BOGESUND DUA	34	81
BRAZOS	12	
BUILDER	1	
CAMPBELL WMEC 32	59	
CELESTINO	3	
CHARLES PIGOTT	18	106
CHASE WMEC 719	38	
CHEROKEE WMEC 165		72
CHEVRON ANTWERP	16	46
CHEVRON COLORADO	6	27
CHEVRON LOUISIANA	6	26
CHEVRON PERTH	10	128
CHRISTIAN MAERSK	6	46
CITY OF DUNDEE	1	
CLIFFORD MAERSK	14	
COLUMBUS LOUISIANA	56	
CONCORDIA SUN	5	
CRESSIDA	81	144
CRYSTAL STAR	57	117
DART EUROPE	73	91
DAVID STARR JORDAN	25	45
DEL CAMPO	19	77
DEL SOL	3	10
DELAWARE SUN	25	54
DIAMOND PHOENIX	42	145
DJATINEGARA	5	
DONA CORAZON II		74
DUANE	19	
EASTERN FORTUNE	28	
EASTERN SUN	9	22
EDGAR M QUEENY	45	68
EL PASO HOWARD BOYD	1	
ENNI G	135	152
ESSO HONDURAS	1	
ESSO SAINT JOHN	56	72
EVER VALUE	13	58
EXPORT CHALLENGER	3	20
EXPORT PATRIOT	25	53
EXXON FLORENCE	16	22
EXXON LEXINGTON	8	46
EXXON PHILADELPHIA	14	17
FEDERAL SUMIDA	2	
FIREBUSH WLB 393	19	4
FRIENDSHIP	17	69
GARDENIA	39	44
GENTSTA	7	
GLACIER BAY		169
GOLDEN DAISY	11	12
GREAT FORT	1	
GREEN HARBOUR	5	4
GUADALUPE I	29	
GULF SKIPPER	1	
HADJI AGUS SALIM	4	
HARKNESS TACS 32	1	
HIKAWA MARU	56	28
HOEGH MERIT	2	
HOTAKA MARU	24	10
HUDSON T-AO 194	1	
INGHAM WMEC 35	2	
ITALICA	2	29
J LOUIS	99	157
JALIYAMINI	47	
JAPAN ACE	97	40
JARVIS WMEC 726	1	64
JOHN LYKES	37	
JUTLANDIA	1	
KENAI	3	21
KOFUKU MARU	18	57
KOREAN LEADER	6	12
L.W. FUNAMOUSER	2	176
LAKE TAHOE	16	
LESLIE LYKES	38	46
LILLOOET	47	43
LONG BEACH	3	
LUIT SCHROEDER	19	
MAHARSHI KARVE	9	11
MANISTEE	30	34
MANULEI	37	105
MARCONA TRANSPORTER	27	96
MARIA U	4	39
MARITIME JUSTICE	12	
MATSONIA	39	102
MAYAGUEZ REEFER		27
MELLON WMEC 717		25
MEONIA	40	121
MILLER FREEMAN	155	177
MING STAR	15	19
MOBIL POWER	13	52
MOBILBAS	6	7
MORMAC BAY	1	
MORMACDRACO	32	77
ACONCAGUA		6
ADRIAN MAERSK	19	65
AGUADILLA	32	123
ALBATROSS IV	62	27
ALLTRANS ENTERPRISE	19	62
AMELIA TOPIC	3	
AMERICAN ACE	49	117
AMERICAN ARCHER	81	92
AMERICAN CHALLENGER	37	66
AMERICAN CORSAIR	16	62
AMERICAN LANCER	67	138
AMERICAN LEGEND	37	116
AMERICAN PACER	A	1
AMERICANA	10	40
ANCO STANE	57	
ANNA MAERSK	38	58
ARCO ALASKA	37	31
ARCO JUNEAU	44	115
ARECIBO	24	
ARNOLD MAERSK	21	55
ASIA BRAVERY	17	79
ASIA INDUSTRY	6	12
ATLANTIC RAINBOW	6	24
AUSTRAL ENVOY	37	47
AUSTRAL PURITAN	24	76
B T ALASKA	29	80
BALTIMORE TRADER	14	197
BARRIER TONSBERG	18	4
BAYAMO	44	
BLESS RIVER	20	
BOWDOIN	31	30
BRILLIANT STAR	11	
BUNGA CHEMPAKA	1	
CAPE ORIENT		47
CHANCELLORSVILLE		35
CHARLESTON	27	62
CHASTINE MAERSK	16	23
CHEVRON VALLEY	2	21
CHEVRON ARIZONA	57	131
CHEVRON COPENHAGEN	7	37
CHEVRON MISSISSIPPI	39	61
CHEVRON SOUTH AMERICA		171
CHRISTOPHER LYKES	4	
CIUDAD DE NEIVA	1	
CLOVER	43	
COMMON VENTURE	51	11
CORAL ACE	19	27
CRISPIN	1	
D ALBERTS	27	32
DAVID D. IRWIN	14	21
DAVIDSON	5	
DEL PONTE	35	16
DEL VALLE	16	29
DELTA BRASIL	3	34
DIANA	37	
DOCEANSRA	7	
DONA MAGDALENA		119
DUSHE	17	
EASTERN MUSE	49	
EASTERN TREASURE	34	66
EDWARD RUTLEDGE	15	
EL PASO PAUL KAYSER	4	
ERNA OLDENDORFF	19	
ESSO NASSAU	58	89
EURO-ASIA CONCORDE	39	53
EVERGREEN WAGO-295	34	
EXPORT CHAMPION	19	38
EXXON BANGOR	41	84
EXXON GETTYSBURG	5	5
EXXON NEW ORLEANS	23	67
EXXON SAN FRANCISCO	24	45
FESTMAR	31	34
FORTALEZA	1	
GAGE LUND	39	
GENTOO	3	
GEORGE B KELEZ	32	13
GLADIOLUS	18	7
GOLDEN GATE	1	
GREAT LAND	78	98
GREEN ISLAND	24	34
GULF PANAMA	17	
GULF TRADER	19	86
HAKUSAN MARU	120	110
HARUNA MARU	129	93
HOEGH HALLARD		3
HOEGH MIRANDA	27	66
HOUSTON		89
HUMACAO	1	
IRIS ISLAND	9	102
ITALY MARU		1
J R GREY		6
JALAYAMUNA	9	
JAPAN AMBROSE	74	98
JEAN LYKES	8	
JOSEPH LYKES	47	
KASHU MARU	68	35
KENNETH E HILL	41	105
KOREAN COMMANDER	17	
KOREAN PRIDE	16	18
LAKE ARROWHEAD	10	43
LASH ITALIA	18	24
LETITIA LYKES	13	
LIONS GATE BRIDGE	89	26
LOUISE	57	146
LYNCH T-AGOR 7	9	50
MALLORY LYKES		132
MANAWAILI	31	66
MARCHEN MAERSK	37	
MARGARET LYKES	14	
MARINE CHEMICAL TRANSP	39	119
MARJORIE LYKES	19	98
MAUI	73	145
MAYON	4	1
MELVILLE	13	91
MERCY	15	
MING GALAXY	24	49
MOBIL AERO		32
MOBILE	6	
MOBILOIL		4
MORMACALTAIR	29	24
MORMACLYNX	22	23
ACUSHNET WAGO 167	9	
ADRIATIK	14	
AIMEE LYKES	19	
ALBERT MAERSK	16	
ALLTRANS EXPRESS	18	62
AMERICA MARU	67	39
AMERICAN ALLIANCE	38	131
AMERICAN ARGOSY	35	120
AMERICAN CHAMPION	1	
AMERICAN EXPLORER	16	9
AMERICAN LARK	48	171
AMERICAN LEGION	28	135
AMERICAN RANGER	24	99
AMOCO CAIRO	1	
ANCO TEMPLAR	64	
ANNIE JOHNSON	25	111
ARCO ANCHORAGE	66	100
ARCO PRESTIGE	14	37
ARGONAUT	23	64
ARTHUR MAERSK	25	82
ASIA FLAMINGO	29	
ASIAN ASSURANCE	2	
AUSTRAL ENDURANCE	27	66
AUSTRAL LIGHTNING	20	41
AUSTRAL RAINBOW	62	91
B T SAN DIEGO	32	191
BARKER MIAMI	13	24
BARRANCA	57	35
BEISHU MARU	30	14
BLUE OCEAN	51	93
BORINQUEN	33	163
BRINTON LYKES	7	
BUNGA MELAWIS	29	
CAPRICORN	4	
CHAPMAN	115	91
CHARLOTTE LYKES	27	6
CHAUVENET T AGS 29	18	121
CHESHIRE	2	
CHEVRON BURNABY		55
CHEVRON EDINBURGH	6	15
CHEVRON OREGON	2	
CHEVRON WASHINGTON	3	
CHUEN ON	18	53
CH APOLLO	7	
COASTAL TEXAS	1	
CONALCO	39	
CORNUCOPIA	40	66
CRISTOBAL	14	114
DAFFODIL	8	48
DAVID P REYNOLDS	32	41
DE STEIGUER T-AEOP12	5	
DEL ORO	22	48
DELAWARE DETTY	11	129
DELTA CARIBE	14	
DISCOVERER OSS	198	208
DOCTOR LYKES	48	144
DORIC	24	47
EAGLE	47	
EASTERN PACIFIC	11	21
EASTERN VISCAYA	9	
EL MEXICANO	5	
ELIZABETH LYKES	39	
ESSO BAYONNE	4	
ESSO PALM BEACH		132
EVER SHINE	28	
EXPORT BANNER	17	
EXPORT COMMERCE	3	39
EXXON BATON ROUGE	39	67
EXXON HOUSTON	10	62
EXXON NEWARK	1	
FAIRHEATHER	22	24
FESTIVALE	2	
FRANCIS SINCERE NO 6	28	
GALLEON AQUAMARINE	5	48
GEN HOYT S VANDENBERG		56
GEORGE M KELLER	22	87
GLOBAL FRONTIER	40	134
GOLDEN GATE BRIDGE	113	77
GREEN ACORN		9
GREEN KORF	15	38
GULF FARMER	1	
GULFQUEEN	1	
HANJIN INCHEON	28	
HELLESPONT GLORY	44	92
HOEGH MASCOT	6	
HOEGH OPAL	10	57
HOWARD B VESPER	25	135
IMACHUS STAR	28	75
IRIS QUEEN	81	
ITAPUAN	5	
JACKSONVILLE	6	
JAMES E O'BRIEN	1	64
JAPAN APOLLO	57	49
JFLA TOPIC	7	
JUPITER NO 1	1	
KOUAI	64	144
KEYSTONER	23	126
KOREAN FIP	18	19
KOYCEDIZ	34	
LAKE PALOURDE	18	75
LASH PACIFICO	18	48
LEXA MAERSK	104	
LLOYD CUIABA	1	
LOUISE LYKES	6	
MADONNA	1	
MALLOW WLB 396	34	
MANUKAI	69	143
MARCONA CONVEYOR	7	82
MARGARET LYKES	24	8
MARITIME HARMONY	25	
MASON LYKES	1	
MAUMEE	17	
MCKINNEY MAERSK	1	
MENESTHEUS	26	
MEXICO	1	
MING GLORY	31	35
MOBIL ARCTIC	14	98
MOBILE MERIDIAN	43	108
MOHAWK	1	
MORMACARGO	23	
MORMACRUFL	2	21
ADABELLE LYKES	10	
AFRICAN DAWN	3	54
ALASKA STANDARD	15	6
ALEUTIAN DEVELOPER	32	52
ALMERIA LYKES	28	
AMERICA SUN	16	118
AMERICAN APOLLO	35	120
AMERICAN ARROW	99	
AMERICAN CHARGER	4	27
AMERICAN HERITAGE	14	8
AMERICAN LEADER	64	104
AMERICAN LIBERTY	48	32
AMERICAN RELIANCE	13	53
AMOCO MILFORD HAVEN		13
ANDERS MAERSK	15	60
ANTE TOPIC	1	42
ARCO CALIFORNIA	43	67
ARCO SAG RIVER	32	91
ARICO	29	52
ASHLEY LYKES	22	69
ASIA HERON	21	
ASIAN EXPRESS	19	93
AUSTRAL ENSIGN	30	110
AUSTRAL MOON	62	70
AVILA	8	29
BACAB	8	
BARBER TAIF	32	35
BAY	6	
BERGLJOT	22	
BLUEBIRD	67	
BOSTON	24	106
BROOKS RANGE	3	
CALIFORNIA RAINBOW	56	39
CARNIVALE	48	56
CHARLES LYKES	54	129
CHARLOTTE MAERSK	4	13
CHEMICAL VENTURE	48	
CHEVRON HILL	23	52
CHEVRON CALIFORNIA	27	49
CHEVRON KENTUCKY	127	
CHEVRON PERNIS	5	119
CHIRA	29	
CITRUS WLB300	13	
CLARA MAERSK	14	27
COLUMBUS AMERICA	58	100
CONCORDIA STAR	18	
COURAGEOUS WMEC 622	15	24
CRYSTAL REED	1	
DANA AMERICA		8
DAVID PACKARD		192
DEFIANCE	2	49
DEL RIO	27	96
DELAWARE II	71	111
DELTA SUD	25	29
DITTE SKOU	32	92
DOLLY TURMAN	16	28
DRUCILLA G	16	
EASTERN DIAMOND	1	172
EASTERN RIVER	24	
EASTERN WORLD	25	18
EL PASO CONSOLIDATED	1	
EMPIRE STATE	16	
ESSO CASTELLON	44	
ESSO PHILIPPINES	2	
EVER SPRING	22	36
EXPORT BUYER	8	26
EXPORT FREEDOM	14	
EXXON CHESTER	1	27
EXXON HUNTINGTON	48	66
EXXON NORTH SLOPE	4	19
FALSTRIA	43	112
FFN MATARENGI	1	
FREDERICK LYKES	23	
GALLEON ONYX	6	
GENEVIEVE LYKES	24	
GLACIER WAGB 4	1	
GLOMAR CHALLENGER	75	175
GRACE	21	
GREEN AUKLET	14	
GREEN VALLEY	38	
GULF MERCHANT	2	
H J HAYNES		173
HANJIN POHANG		23
HIEI MARU	119	80
HOEGH MERCHANT	14	3
HOUSING BREEZE	22	35
HOWELL LYKES	19	77
IMPA	21	159
IRONWOOD WLB 297	2	
IVAN TOPIC	15	45
JADRAN	6	
JAMES LYKES	21	
JAPAN CADDO	14	96
JOHN A. MCCONE		203
JUTHLANDIA	40	84
KEIYO	20	117
KNOPP	109	146
KOREAN JUPITER	8	
KOPAN	25	
LAKE SHASTA	8	36
LAUREL WLB2901	5	
LIBRA	1	
LOMPOC	3	11
LUIGI GRIMALDI	25	
MADALENA	34	
MANHATTAN	25	40
MANULANI	75	158
MARCONA EXPORTER	52	195
MARIA TOPIC	15	
MARITIME INVESTOR	4	
MATHIESON	15	83
MAYAGUEZ	27	148
MEADOWBROOK	1	1
MENINA ALICE	21	
MIDGETT WMEC 726	64	81
MING MOON	33	
MOBIL LUBE	28	26
MOBILFUEL	14	43
MORANT	28	
MORMACBAHN	13	43
MORMACSABA	4	

TOTAL WEATHER REPORTS RECEIVED FROM US COOPERATIVE OBSERVING SHIPS MAY AND JUNE 1981

SHIP NAME	VIA RADIO	VIA MAIL
MORMACSEA	21	65
MORMACVEGA	27	53
NAVASOTA		167
NEPTUNE DIAMOND	43	82
NEW JERSEY MARU	80	70
NOORAAY	54	69
NORDIC LOUISIANA	108	
NORWAY	69	
OCEANIC	138	173
OGDEN THAMES	19	
OLGA TOPIC	4	
ORE JUPITER	31	
ORIENTAL ESEARCHER	44	51
ORIENTAL LEADER	14	24
ORIENTAL TAIO		100
OVERSEAS CHICAGO	10	17
PACARON	14	21
PACEMPEROR	17	
PACIFIC ERA	30	
PACLACY	3	9
PACNORLF	15	11
PAN ASIA		30
PARALLA	21	28
PENNMAR	8	
PHILADELPHIA	52	90
PIONEER MOON	14	47
POLYNESIA	62	129
PRESIDENT CLEVELAND	35	39
PRESIDENT HOOVER	85	137
PRESIDENT MADISON	27	110
PRESIDENT TAFT	63	113
PRESIDENT VAN BUREN	62	120
PROSPERITY QUEEN	24	
QUEENS WAY BRIDGE	79	69
RADIANT STAR	1	
REGENT CEDAR	49	59
RESOLUTE WPC 620	19	
RIO COPPE	1	
ROSE CITY	28	100
SALVADOR	19	34
SAN JUAN	80	154
SANTA ADELA	4	26
SANTA ELENA	47	99
SANTA MARIA	43	95
SARPONA	31	98
SEA TRANSPORT	20	
SEALAND DEFENDER	40	128
SEALAND EXCHANGE	6	17
SEALAND GALLOWAY	52	129
SEALAND MARKET	48	119
SEALAND RESOURCE	13	46
SEATRAIN TRENTON	72	
SENT ROKAKO	44	90
SHIVE OK	7	
SILVER PHOENIX	20	29
SINCERE NO 5	17	
SKYWARD	56	75
SONIO INTREPID	11	95
SOUTHWEST CAPT	71	
STAR DOVER	34	107
STELLA LYKES	7	
STORIS WASB 39	4	
SUSQUEHANNA	24	134
TALISMAN	17	26
TEXACO GEORGIA		31
TEXACO RHODE ISLAND		4
TFL DEMOCRACY	6	21
THOMAS WASHINGTON	40	128
TOKO BREMER	40	
TONOI TOPIC		107
TOYOTA MARU 12	113	194
TRIUMPH	24	
UNITED SPIRIT	12	81
VAN CONQUEROR	29	42
VANGUARD		60
VERRAZANO BRIDGE	52	29
VISHVA SIDDHI	2	60
WESCP EXPRESS	119	140
WHITING	8	
WOODRUSH WLB407	3	
YOCONA WMEC 148	32	
ZAPATA COURIER	1	
ARWA	11	29
DZMO	9	32
DS6F	16	35
D7AH	14	44
D6FE	13	34
ELAH3		29
ELA43	9	117
ELIJ	11	5
ELYF	21	29
H3AT		80
HALO	13	107
HOIS	8	9
H9UV	14	46
JM2P	42	61
KRJF	48	100
KSFJ	33	99
LOTO		19
MDCY	69	107
OWBI	27	56
S6E5	1	5
WDZ3	34	84
WSZN2220		14
WYS3261		30
3EJX	13	17
5HDJ	1	1
7LDN	21	16
9VXU		139

SHIP NAME	VIA RADIO	VIA MAIL
MORMACSTAR	20	41
MORMACWAVE	17	
NECHES	59	63
NEPTUNE JADE	22	
NEW JERSEY SUN	7	
NOPAL BRANCO		24
NORSE PILOT	48	89
NURA DEL MAR	10	
OCEANOGRAPHER	94	93
OGDEN WILLAMETTE	7	
ORANGE	113	
ORE MERIDIAN	36	
ORIENTAL EXECUTIVE	29	85
ORIENTAL MERCHANT	30	132
OTTO N. MILLER	9	147
OVERSEAS JUNEAU	44	
PACPRAGNESS	16	23
PACGLORY	21	
PACIFIC PEACE	17	50
PACMAJESTY	14	19
PACPRINCE	29	
PAN DYNASTY	11	
PASSUMPSIC AO-107		25
PEPPIPA D'ECA	1	
PHILIPPINE CORREGIDOR	17	57
POINT WARDE	1	
PORTLAND	77	123
PRESIDENT FILLMORE	55	119
PRESIDENT JACKSON	48	90
PRESIDENT MC KINLEY	32	96
PRESIDENT TAYLOR	15	1
PRESIDENT WILSON	16	
PROVENCIA DE EL ORO	14	27
QUINTINA	39	45
RAINIER	6	10
REGINA CELI	1	
RICHARD	32	51
ROBERT E LEE	25	49
ROYAL VIKING SEA	9	20
SAM HOUSTON	5	
SANKOSTAR	10	
SANTA BARBARA	29	55
SANTA FE	47	58
SANTA MARIANA	27	77
SATSUMA	27	56
SEALAND ADVENTURER	21	28
SEALAND DEVELOPER	60	135
SEALAND EXPRESS	17	16
SEALAND INDEPENDENCE	43	114
SEALAND PATRIOT	97	115
SEALAND VENTURE	15	16
SEATRAIN YORKTOWN	7	
SEPTA	29	95
SHIRLEY LYKES	8	
SIMBA	42	95
SINCLAIR TEXAS	1	77
SNOW CRYSTAL	4	33
SOLON TURMAN	31	
SPIRIT OF LIBERTY	1	
STAR HONGKONG	17	26
STOLT LION	8	
STRAFFAN HAVSER	10	13
SWEETBRIER WLB 405	28	
TAMPA	29	73
TEXACO GWENT	26	
TEXAS	24	34
TFL FREEDOM	10	32
THOMPSON LYKES	31	
TOKYO RAINBOW	25	76
TONSINA	23	104
TOYOTA MARU #3	67	32
TROPICANA	13	
UNIVERSE	23	
VAN FORT	9	58
VELMA LYKES	32	108
VIENNA WOODS	47	59
WALTER RICE	44	147
WESTERN HIGHWAY	51	36
WILLIAM E MUSSMAN	15	
WORLD CANDOUR	54	
YOUNG AMERICA	9	23
ZIM MONTREAL	49	54
ARZW	16	140
DZUW	5	6
D5XA	9	68
D7BV		40
D7DR		31
EAFC		49
ELAJ8		29
ELAY5	2	12
ELNC	6	47
ELYM	24	93
HA8E	24	57
HBTC	29	38
HOMI	41	137
HRTH		11
JPND	36	26
KHBP	32	135
KSFK	17	37
LPCB	1	6
NMMY		102
PPGH	10	44
SA2T	59	161
WFCT		29
WTP6158		14
ZCKV	9	6
3EOL		2
5MJF	7	3
8KKF	93	46

SHIP NAME	VIA RADIO	VIA MAIL
MORMACSUN	4	65
MUNRO WMEC 724	83	
NEPTUNE AMBER	25	29
NEPTUNE RUBY	30	
NEW YORK MARU	54	55
NOPAL SEL	18	49
NORTH STAR III	40	21
OCEAN CROWN	4	
OCTA	45	131
OJI GLORIA	32	
OMCO MINER	17	27
ORIENTAL CHAMPION	18	
ORIENTAL EXPORTER	14	30
ORIENTAL SOVEREIGN	27	34
OVERSEAS ALEUTIAN	9	
OVERSEAS MARILYN	40	29
PACDUCHESS	3	
PACIFIC ACE	24	
PACIFIC SAGA	39	6
PACMERCHANT	6	
PACPRINCESS	6	
PAN PACIFIC	7	
PAUL L FAHRNEY		118
PERENNIAL ACE	90	267
PINK SKY	2	
POLAR SEA	81	87
POTOMAC	5	59
PRESIDENT GARCIA	12	46
PRESIDENT JEFFERSON	71	33
PRESIDENT PIERCE	48	116
PRESIDENT TRUMAN	64	139
PRINCE OF TOKYO	35	
PUNTA BRAVA	1	
QUIXADA	49	55
RED JACKET	9	51
RESEARCHER	123	186
RIGOLETTO	34	65
RODRIGUES CABRILHO	83	76
RUTH LYKES	4	
SAMOA	22	40
SANKOSUN	4	
SANTA CLARA	15	13
SANTA ISABEL		68
SANTA MERCEDES	35	53
SCILLA	31	
SEALAND COMMERCE	51	90
SEALAND ECONOMY	58	103
SEALAND FINANCE	61	115
SEALAND INNOVATOR	58	110
SEALAND PIONEER	6	11
SEATRAIN INMEPENDENCE	18	
SEATTLE	22	94
SEVEN OCEAN	7	
SHUNAIMO	43	107
SINALOA	49	100
SKAUGRAN	62	75
SNOWDRIFT	9	28
SOUTHERN CROSS	2	
SPRAY DERRICK	19	
STARWARD	32	45
STOLT LLANDAFF	7	53
SUGAR ISLANDER	36	135
T F L LIBERTY	2	26
TAURUS		73
TEXACO MASSACHUSETTS	1	
TEXAS CLIPPER	22	
THOMAS G THOMPSON	104	104
THOMPSON PASS	7	37
TOLUCA	1	
TOWNSEND CROMWELL	112	119
TRANSCOLORADO	17	
TSU	18	27
UNIVERSE KURE	6	
VAN HANK	46	89
VENTUROUS WPC 625	9	
VILLANGER	3	8
WASHINGTON TRADER	40	98
WESTERN SUN		53
WILMINGTON SETTY	57	94
WORLD HERCULES	3	13
YOUNG SEAGULL	43	
ZIM NEW YORK	1	
DNAD	7	34
DZZP	25	50
D5XO		62
D7BV		17
EMBK		33
ELAD3	24	99
ELCJ	21	17
ELUU	12	31
HBFW	12	84
HP8O	7	54
HRCH	13	62
HRWO	21	33
JEUS	21	12
JPRS	18	40
KTCP	9	23
KSLB	19	84
NAA		1
NNBN		487
PPTI	29	22
VRPE	104	156
WBJF	52	113
WBJF		51
WYS5902		51
3FBR	7	16
5LUB	18	117
8MYK	31	32
9VXS	13	18

SHIP NAME	VIA RADIO	VIA MAIL
MORMACTIDE	33	53
NANCY LYKES	11	
NEPTUNE CRYSTAL	23	
NEW GOLDEN PHOENIX	72	136
NEWARK	34	53
NORDHVAL	2	
NORTHERN VICTORY		13
OCEAN LOG	39	48
OGDEN JORDAN	62	144
OLEANDER	77	99
ORCO TRADER	1	
ORIENTAL COMMANDER	11	
ORIENTAL IMPORTER	3	7
ORIENTAL STATESMAN	37	36
OVERSEAS ARCTIC		12
OVERSEAS NEW YORK	6	37
PACDUKE	6	
PACIFIC ARROW	70	56
PACIFIC VENTURE	80	170
PACMONARCH	17	1
PACSTAR	22	10
PAN WESTERN	18	10
PAYSANDU	2	
PERRYVILLE	13	99
PIONEER CONTENDER	11	56
POLAR STAR WARB-10	29	
PRESIDENT ADAMS	9	
PRESIDENT GRANT	47	126
PRESIDENT JOHNSON	75	92
PRESIDENT POLK	37	100
PRESIDENT TYLER	42	93
PROSPERITY	9	
PUNTA MALVINAS	10	
R G FOLLIS	15	83
REGENT BOTAN	1	
RESOLUTE	22	43
RIO ARAUCAN	40	41
ROSE		175
SACRAMENTO	1	
SAMUEL S	12	13
SANSINENA II	19	36
SANTA CRUZ	32	11
SANTA JUANA	6	
SANTA PAULA	11	20
SEA LAND VOYAGER	40	110
SEALAND CONSUMER	51	59
SEALAND ENDURANCE	74	125
SEALAND FREEDOM	51	100
SEALAND LEADER	12	74
SEALAND PRODUCER	13	81
SEATRAIN ORISKANY	3	38
SEDGE WLB 402	7	
SHELDON LYKES	17	
SIENA	45	40
SINCERE NO 3	17	
SKOURDO	22	96
SOCONY VACUUM	32	95
SOUTHWARD	13	24
STAR DIEPPE	35	
STATE OF MAINE	47	79
STONEWALL JACKSON	2	25
SURVEYOR	90	
TAIKO VENTURE	22	
TERRIER	8	49
TEXACO NORTH DAKOTA	1	
TEXAS TRADER		19
THOMAS NELSON	9	
TILLIE LYKES	52	38
TOWAMI MARU	41	20
TOYOTA MARU 10	103	73
TRAVIATA	11	26
TYSON LYKES	34	107
VALLEY FORGE	9	
VAN TRIUMPH	17	85
VERACRUZ I	1	
VIOLET	31	22
WASHINGTON WOOD	3	98
WESTWARD VENTURE	83	114
WISTERIA	28	27
YAMASHIN MARU	116	117
YUKON T-AO 152	23	72
A7P8	4	11
D2CL	5	20
D5EN	16	45
D5ZP	34	52
D9CR		87
ELAD4	1	24
ELAR4		1
ELFY		16
ELKT	61	77
HA5N		21
HBJO	57	111
HBWI	1	15
HDNR	14	14
JMVI	113	90
JWHN	33	61
KPAL	3	4
KXBR		26
N8SZ		57
N9SI		22
SACF	36	47
VRBB	77	98
WJKG		15
WYS5806		12
3EJE	6	43
5MOI		35
6ZRT	17	104
9VUB	11	99

SUMMARY: GRAND TOTAL VIA RADIO 22839 GRAND TOTAL VIA MAIL 41592

Rough Log, North Atlantic Weather

August and September 1981

ROUGH LOG, AUGUST 1981--The most favored path for storms this month was from the Great Lakes to Newfoundland to Iceland. This corresponded to a climatological primary track. The path was reinforced north of Newfoundland by a secondary track from Hudson Bay. No storm crossed the European west coast south of 60°N except for Norway.

The dominant pressure system was the Azores High at 1025 mb near 38°N, 29°W. This was 2 mb higher than normal and 450 mi northeast of its normal location. The Icelandic Low was 1006 mb on the southeast coast of Greenland. This was about midway between the two normal 1008-mb centers. There also was a 1011-mb LOW center over Finland. A deep 1001-mb LOW near the North Pole did not directly affect the North Atlantic weather.

The largest anomaly centers were positive, a 9-mb center over Ireland and a 5-mb one over northern Quebec. The LOW near the North Pole resulted in a negative 11-mb center with a negative 8-mb subcenter over northern Greenland.

The upper air flow at 700 mb had a long-wave trough that stretched southwestward from southeastern Greenland and paralleled the west coast of the United States. There was a smooth ridge over the United Kingdom that degenerated into a LOW near Lisbon. The HIGH was centered along 30°N latitude between 40° and 50°W longitude. The anomaly centers approximated the surface anomaly centers.

Tropical storm Cindy and hurricanes Dennis and Emily roamed this ocean.

Extratropical Cyclones--The first 10 days of the month the Azores High was well entrenched in the vicinity of 40°N, 30°W. The cyclones followed a path from the Canadian Maritime Provinces to Iceland. During the middle of the month the HIGH retreated south and several frontal waves were able to form over the central ocean. The HIGH built northward again during the third week. The extratropical remains of hurricane Dennis penetrated into the central ocean before dissipating during the last week. Other cyclones were able to track farther to the southeast.

There was a hint of this LOW in the analysis for several charts. A fairly well-developed storm was moving northward over Baffin Island on the 12th. This LOW was apparent south of Cape Chidley on the 13th. There already was a southwesterly circulation over the salt water. At 0600 the LA COSTA and the OCEA west and east of Newfoundland had winds near 40 kn. At 1200 the ZAPA (47°N, 49°W) reported 53 kn. At 1800 the AMERICAN ACCORD (40°N, 59°W) found 47 kn as a wave formed on the front east of Cape Cod. On the 14th the PIERRE RADISSON near 60°N, 68°W, in the Hudson Strait reported northerly 55-kn winds.

The storm had been traveling southeastward, but on the 14th it turned northeastward. It moved over Kap Farvel on the 16th. There were isolated minimal gale reports during this period. On the 19th the LOW moved over Norway.

This LOW formed on the coast of Maine on the 17th. Gales were found over the Grand Banks on the 18th. On the 19th SEDCO and supporting ships in the area reported 40- to 45-kn winds. The AMBROSE SHEA (46°N, 60°W) had 44 kn. The storm was traveling northeastward as a frontal wave on the 20th. Weaker frontal waves were forming and dissipating on the front to the southwest. The MARSEILLE found 44-kn winds out of the southeast on the 22d with 20-ft seas near 46°N, 30°W. Later in the day the fishing fleet near Iceland was reporting winds in the 40-kn range. The FRITHJOF called the winds 57 kn and the waves 20 ft. The storm was 986 mb at 1200 on the 23d west of Iceland. The wind reports had decreased to less than gale force. The storm dissipated on the 25th.

This was the extratorpical continuation of hurricane Dennis. Dennis weakened to a tropical storm on the 21st and was considered extratropical on the 22d. At 0000 the ACHILLES (35°N, 61°W), about 240 mi southwest of the center, had 45-kn winds and 26-ft waves. At 1200 three ships had gales, both north and south of the center, with the SANKOSTAR indicating 23-ft seas in the southwest quadrant. On the 23d the storm was 997 mb near 44°N, 41°W (fig. 17).

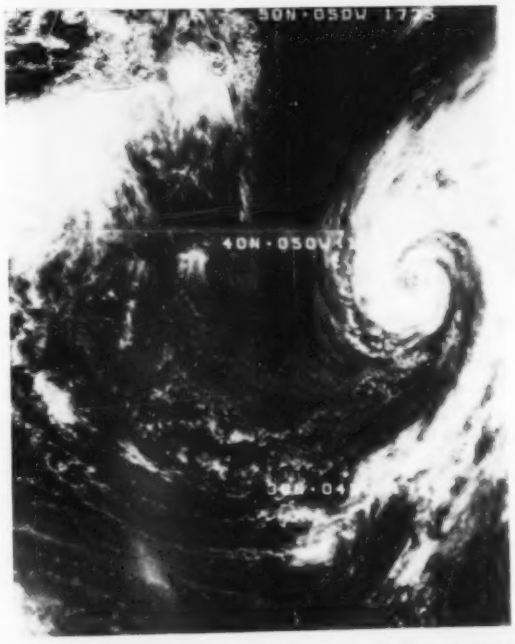


Figure 17.--The storm had moved to slightly south of 40°N at 40°W by 1730. Another look at the storm can be seen in the next figure.

The CARIBIA EXPRESS (40°N, 46°W) had 60-kn winds out of the north with 20-ft seas. The ALBERTIS at 36°N, 46°W, found 23-ft seas and 30-ft swells, also in the southwest quadrant in the same relative position to the center as the other high wave reports. The JEAN LYKES found 40-kn gales on the 24th.

The storm was weakening on the 24th as it turned northward. A complex LOW and frontal system was moving northeastward in the western quadrant. The HOLSTEN CLIPPER, south of the center, had 47-kn winds. The approaching storm absorbed this circulation on the 26th.

A front paralleled the Gulf Coast on the 21st. Waves were rippling along the front. On the 22d one of these crossed into the Atlantic and started deepening near Cape Hatteras (fig. 18). On the 24th the storm was 994 mb near 42°N, 60°W. Several ships were reporting gales. The EEKLO (38°N, 66°W) had 23-ft waves, another ship (41°N, 62°W) had 20-ft waves, and another near 41°N, 59°W, had 26-ft waves. A U.S. ship reported 54-kn northerly winds near the storm's center on the 26th.

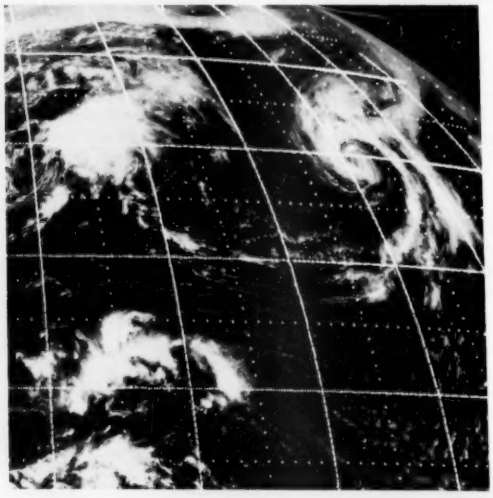


Figure 18.--The storm is centered near 39°N, 70°W, at 1700. The heavy clouds northeast of the center are associated with overiding on the warm front. The previous storm can be seen in the far right.

Mainly gales continued into the 27th, but the VRKB (49°N, 29°W) radioed a report of 68-kn westerly winds with 26-ft waves. The storm weakened on the 28th and disappeared east of Iceland on the 29th.

This frontal wave was first detected on the 27th near Sept-Iles. At 1200 on the 29th the storm was 997 mb near 58°N, 37°W. The PEARL (55°N, 29°W) was east of the occlusion with 52-kn southerly winds and 26-ft waves. The occlusion had just passed CHARLIE, which had 19-ft swell waves still from the south. The PEARL had 33-ft waves at 1800. Other ships were reporting gales up to 40 kn. By the 0000 chart of the 30th, this LOW could not be found, but another had developed near Kap Farvel.

Tropical Cyclones, North Atlantic--Tropical storm Cindy was picked up as a subtropical depression on the 3d near 37°N, 65°W. Late in the day she acquired tropical characteristics and was christened Cindy, based on satellite and ship reports. Cindy was moving east-northeastward at about 10 kn. Peak winds climbed to 50 kn as the storm passed about 350 mi south-southeast of Halifax, Nova Scotia, on the 4th. By the 6th she became extratropical as she swung northeastward close to Newfoundland.

The system that became hurricane Dennis was well organized as it moved off the northwestern coast of Africa on the 5th. It became a tropical depression the following day and a tropical storm on the 7th, just southwest of the Cape Verde Islands. Dennis moved westward across the Atlantic and into the Caribbean Sea during the following week. Heading west-northwestward Dennis dropped back to depression strength just west of Martinique late on the 11th. Varying in intensity Dennis regained tropical storm strength as he approached the south coast of Cuba on the 15th. Turning northward the tropical storm threatened the Florida Keys. The center of the storm moved up through the Florida Straits on the 16th, passing the lower Florida keys during the evening and onto the lower southwest coast of the Florida Peninsula early on the 17th. He then moved slowly north-northeastward, finally emerging out into the Atlantic, early on the 19th, between Cape Canaveral and Daytona Beach (fig. 19).

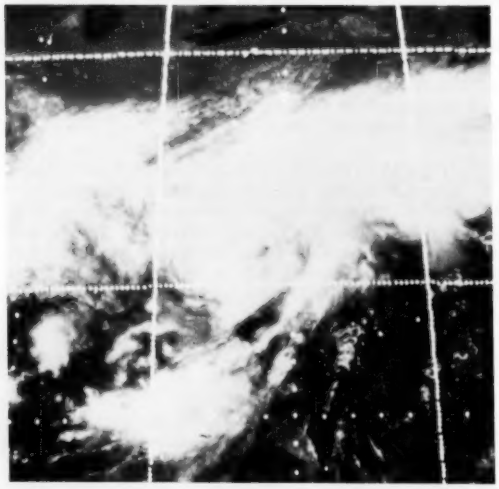


Figure 19.--Dennis was east of Jacksonville, Fla., at 1700 on the 19th.

The worst damage in Florida was caused by flooding in the extreme southern sections, where rainfall amounts of up to 20 in were reported. Despite this, most of the rain was beneficial due to the drought that had gripped many areas of the State prior to the storm. Dennis was not well organized, and highest winds occurred in squalls east of the center. Gusts of 50 kn were reported along the lower southeast coast. Tides ran 1 to 3 ft above normal. A 315-ft freighter was blown aground off Fort Lauderdale.

Dennis brushed the Carolinas on the 19th and 20th. North of Charleston he triggered 24-hr rainfall amounts of 5 to 10 in. He came ashore near Morehead City early on the 20th. Rainfall amounts ranged from 4 to 9 in with a 15-in maximum near Tabor City in Columbus County. Highest winds were reported at Frying Pan Shoals Light Tower, where sustained winds reached 47 mi/h and gusts climbed to 59 mi/h. As Dennis moved off Cape Hatteras on the 20th, winds near his center reached hurricane strength for a few hours. Once back into the Atlantic he began to weaken, however, and lose tropical characteristics. Dennis' remnants finally dissipated over the northern North Atlantic on the 25th.

At monthend hurricane Emily developed from a low-pressure system near Bermuda. By the 1st Emily's circulation enveloped the island, where a 994.9-mb pressure was reported. The tropical storm was heading north-northeastward at 5 to 10 kn. By the 3d the storm became better organized, and its center was located about 185 mi north of Bermuda. On noon the following day Emily became a hurricane as 75-kn winds roared around her 970-mb center, which was located at 37°N, 61.5°W. A few hours later winds increased to near 80 kn as central pressure fell to 967 mb. Large swells from this system were pounding the northeast and middle Atlantic U.S. coast. Early on the 5th Emily's center was about 275 mi south of Sable Island as she moved northward at about 5 kn. The storm weakened slowly as it moved over colder waters. On the 7th Emily dropped to tropical storm strength some 415 mi south-southwest of St. John's, Newfoundland, as she headed slowly east-northeastward. Maximum winds remained at 40 to 45 kn for the next several days as Emily turned extratropical.

Casualties--The NICOLINE MAERSK grounded in the River Scheldt in fog on the 4th. The IBN SINA II contacted the SANDETTIE N. buoy in fog on the 7th. The 21,345-ton OCEAN GIRL suffered weather damage on the 9th to the 11th and deviated to Curacao. The tanker HARALABOS lost an anchor and chain at Maloga Roads on the 10th in bad weather.

The two American ferries NAUSHON, carrying 350 passengers, and the AURIGA, carrying 16 passengers, collided in fog early on the 10th near Woods Hole, Mass. Three crewmembers and 17 passengers were injured. The Spanish LUCIA DEL MAR stranded in mud in fog at Leixoes, Portugal, on the 14th.

The hydrofoil ferry PRINCESSE CLEMENTINA collided with the container vessel BUENOS AIRES early on the 14th, 5 mi off Calais. A sister jetfoil, the PRINSES STEPHANIE took on the 208 passengers.

The crane barge FAIRALP I loaded with stone grounded south of New Harbor at Visby, Sweden, in strong winds. The GEORGIOS T. KOROPOULIS had weather damage on the 22d and 23d on a voyage from Newport News to Bilbao. The 4,073-ton VALENTINA parted ropes at Piraeus on the 23d in stormy weather.

Other Casualties--The LNG tanker GUARUJA contacted the pier in strong winds at Montevideo on the 8th.

ROUGH LOG, SEPTEMBER 1981--There were fewer than usual significant extratropical cyclones this month. The month is noted for tropical cyclones. There was a short favorite path from off Cape Cod to about 53°N, 45°W. A secondary track extended from near 50°N, 25°W, northeastward to Scotland, then northward into the Norwegian Sea. One storm tracked from near Cape Cod to southern Ireland, then to the North Sea, and northward over the Norwegian Sea.

The Icelandic Low became more prominent this month at 1000 mb south of Iceland near 60°N, 20°W. This was 5 mb lower than normal and about 200 mi east of its normal position. There was an anomalous 1009-mb Low on the east coast of Hudson Bay. The Azores High at 1024 mb was 3 mb higher than the climatic normal and about 180 mi to the southeast. The average pressure over the eastern United States was near normal, but there was an anomalous 1013-mb Low about 200 mi southeast of Nova Scotia.

There were three anomaly centers of importance to the weather over the ocean; two were negative. The first was minus 7 mb near 58°N, 17°W. The other was minus 4 mb near 40°N, 60°W. The plus 8-mb anomaly center was over the Davis Strait. Positive values covered the Labrador Sea, Greenland, Labrador, and the northern Canadian islands.

The primary Low center at 700 mb was over the North Pole. A trough extended southward into Hudson Bay. There was a secondary Low south of Iceland with a trough west of the European coast. A short-wave trough was indicated off the east coast of the United States.

There were five hurricanes this month: Floyd, Gert, Harvey, and Irene.

Extratropical Cyclones--On the 2d there was an area with several weak low centers south of Iceland and west of Ireland. On the 3d these consolidated into one center near 54°N, 28°W. A few minimal gales were beginning to blow. At 1200 on the 5th the 990-mb LOW was north of the Shetland Islands. Fishing vessels were finding gales to strong gales. A U.S. vessel reported 56-kn winds near 69°N, 06°W. On the 6th there were many reports of gales and strong gales, also wave reports over 20 ft. Among others, the DISCOVERY (66°N, 09°E) and the RAVENSCRAIG (65°N, 06°E) had winds of 45 to 52 kn with waves of 39 and 33 ft, respectively. Ocean Weather Station MIKE measured 47-kn winds. By the 7th the storm was well into the Arctic.

This cyclone formed in a col area resulting from Emily's weakening and another cyclone moving northeastward over Iceland on the 9th. It developed rapidly and had a large circulation by 1200 with some gales reported. At 1200 on the 10th, the storm was 980 mb near 57°N, 15°W. Several ships had winds over 40 kn. LIMA measured 46-kn winds and 23-ft seas. The DART CANADA (53°N, 23°W) also had 46 kn with 26-ft waves. There were not so many high wind reports on the 11th, but the storm looked as severe as ever. The MATCO AVON (59°N, 02°E) found 50-kn winds and 20-ft waves. The storm turned westward on the 11th and deteriorated.

Monster of the Month--Quebec Province produced this storm on the 12th. It traveled eastward and was near 54°N, 39°W at 1200 on the 15th. The Polish ship SPZL (45°N, 39°W) had 52-kn winds. The OPALIA (56°N, 33°W) was in 42-kn winds on the 16th. The C.P. VOY-

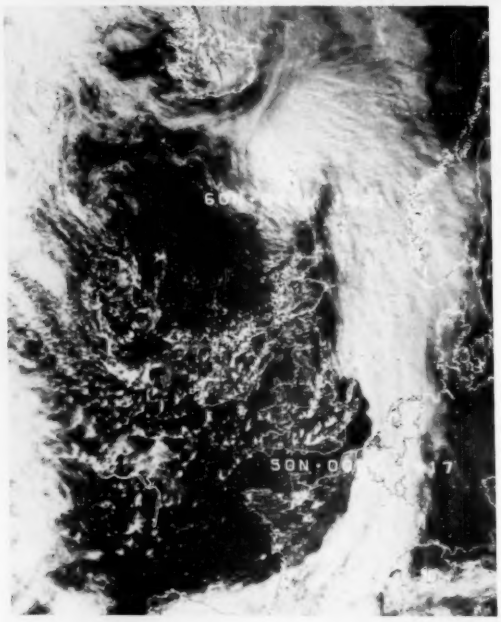


Figure 20.--The original LOW is south of Iceland. A second center has formed north of Scotland at this time. There also appears to be a cyclonic formation near 57°N, 22°W.

AGEUR (53°N, 31°W) had 40-kn winds and 23-ft high waves on the 17th. There were many gales on the 18th and the southerly circulation reached the North Sea (fig. 20). Winds were reported as high as 58 kn by the 9VUR. The storm stalled near 61°N, 18°W, and on the 19th a strong frontal wave moved through the southern circulation. There were many gales in the 40-kn range. ROMEO hit 40 kn with 20-ft seas. Fishing vessels south of Iceland had northerly winds generally in the 40's, but one off the northwest coast reported 60 kn.

On the 20th the frontal wave became the strongest of the two centers. It was 970 mb over the Irish Sea at 0000 on the 20th (fig. 21). Ships and platforms on the North Sea had a tough time with winds to 50 kn and waves to 25 ft. By the 21st this was the only LOW center. The strong winds in the eastern half had reached the Norwegian Sea at speeds up to 50 kn. The

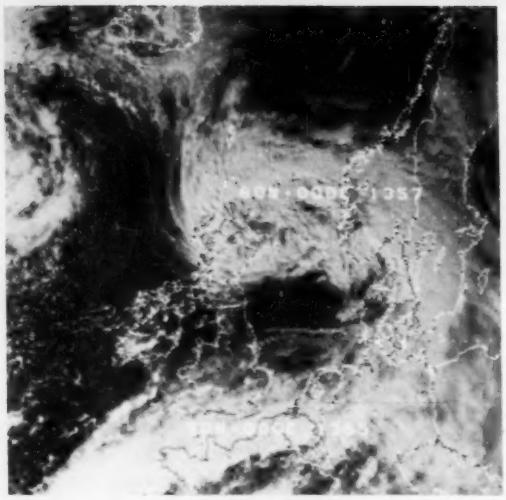


Figure 21.--The new storm center is over the Orkney Islands. The front lies over the English Channel with another weak wave near Brest, France.

storm was weakening on the 22d, and there were only a few gale reports. It disappeared on the coast of Norway on the 23d.

At least three people died in the up to 70-kn winds that swept Britain. Crews of several small vessels had to be rescued. The trawler LE CHAMOIS sank north of Ushant, but five of the six crewmen were rescued. The TUNGUFOSS sank in force 10 winds and rough seas near Lands End. The 11 crewmembers were rescued. Twelve people were rescued by helicopter from the MFV 1057 which was sinking near Maplin Sands.

This storm formed over Charleston, S.C. It traveled along the U.S. East Coast, picking up strength and producing a few gales. As it moved over the Gulf of St. Lawrence at 975 mb on the 20th, the JOHN CABOT found 50-kn winds off Long Island. At 1200 the ZAPATA had 55-kn winds from the south. The LUISE BORNHOFEN had 36-ft swells, and the THALASSE had 26-ft seas. The storm had moved to 56°N, 57°W, by 1200 on the 21st. The NORTHERNSHELL found 50-kn winds off Hopedale, while the BEN OCEAN LANCER also had 50-kn winds with a pressure of 970 mb very near the center of the storm. There were only gale reports on the 22d and 23d, but CHARLIE measured 25-ft swell waves in the southwest quadrant of the storm. A second LOW had now formed east of the original center and gradually became the primary center of the storm on the 24th. CHARLIE was still contending with 20- to 25-ft waves on the 25th. The TILLIE LYKES found 45-kn winds on the outer southwestern edge of the storm. Yet another center formed west of Lands End. This increased the southern gradient and sharpened the trough. ROMEO had gales with 20-ft seas. Another switch of centers took place late on the 26th, and the storm was 973 mb near 57°N, 05°W, at 0000 on the 27th (fig. 22). There were many high wind and wave reports off the east, north, and

west coasts of the United Kingdom. The storm rapidly lost strength on the 28th as another strong storm moved over the north central ocean.

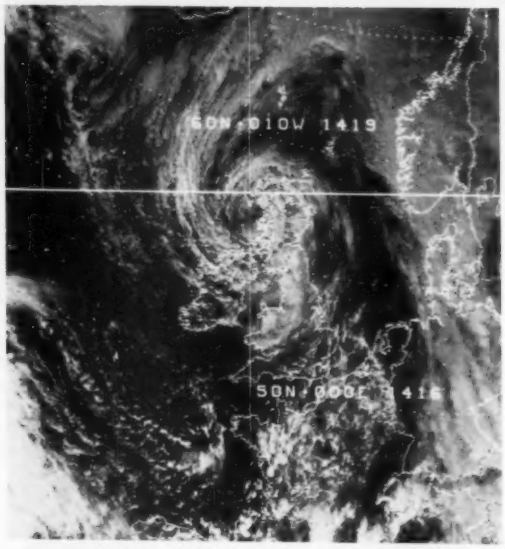


Figure 22.--This storm is also over Scotland, a favorite place for severe storms this month.

The northern plains of the United States produced this storm. It traveled eastward and moved offshore near Cape Cod on the 23d and started intensifying. On the 24th a second LOW formed to the east, and there were a few gales. By 1200 on the 26th the two centers had combined into one 978-mb LOW near 51°N, 50°W.

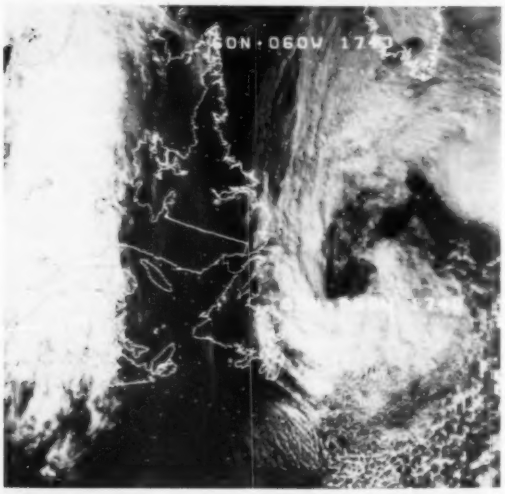


Figure 23.--Strong, cold northerly winds from Baffin Bay can almost be felt in this image as they pour energy into the storm.

There were some gales up to 45 kn and waves approaching 20 ft. On the 27th the OCEA (48°N, 50°W) reported 55-kn winds and 23-ft seas. By 1800 the winds increased to 60 kn (fig. 23). The ATLANTIC CAUSEWAY (49°N, 42°W) found 33-ft waves from the southwest. The AMERICAN ARCHER had 50 kn on the 28th. Other ships were reporting 20- to 25-ft waves. The ZAPATA was measuring winds near 50 kn and waves of 20 ft.

The storm started weakening late on the 28th. There were swell reports up to 20 ft on the 29th as the storm turned northeastward. Another center formed southwest of the original center and 20-ft waves continued into the 30th. On October 1 the original center combined with another LOW center and Jan Mayen recorded 45-kn winds. This center continued northward over the Norwegian Sea.

Tropical Cyclones--Hurricanes Floyd and Gert formed within a few days of each other and followed a similar path. Floyd reached tropical storm strength on the 5th about 80 mi north-northeast in the Virgin Islands. Heading northwestward at about 10 kn, he intensified to hurricane strength the following day. By the 7th (fig. 24) it was evident that Floyd was starting to recurve after he crossed the 25th parallel near 69°W. He continued to intensify and early on the 8th, 85-kn winds roared around a 975-mb center, which was just 225 mi southwest of Bermuda and heading northeastward.

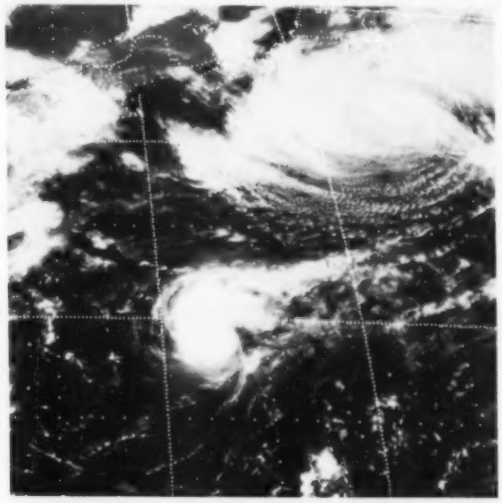


Figure 24.--Hurricanes Emily and Floyd are both in this image at 1700 on the 7th. Emily far outweighs Floyd, but Floyd is the stronger.

Gert, meanwhile, was just reaching tropical storm strength near Guadeloupe in the french Antilles early on the 8th; this was some 300 mi southeast of where Floyd first reached this intensity. Gert headed westward then turned toward the northwest once into the Caribbean Sea. On the 9th she moved across Puerto Rico and paralleled the north coast of the Dominican Republic. Her maximum winds were estimated at about 45 kn as she made her way through the southeastern and central Bahamas before turning northward

on the 10th.

By this time Floyd had weakened to tropical storm strength and was headed east-northeastward. Floyd had moved just south of Bermuda on the 8th, but his central pressure had risen to 994 mb with a small area of minimal hurricane-force winds near this center. A short time later Floyd was a tropical storm. On the 11th after crossing the 40th meridian near 35°N, Floyd headed northeastward and began to turn extratropical.

Gert by this time had achieved hurricane status and turned northeastward. On the 12th after crossing the 30th parallel near 71°W, winds increased to 75 kn around Gert's 988-mb center. Gert was moving at about 15 kn. During the morning of the 12th the storm passed about 150 mi northwest of Bermuda and turned toward the east-northeast. Later in the day winds dropped below hurricane force. Gert continued to parallel Floyd's course for the next several days. Like Floyd she moved through the Azores as she was turning extratropical on the 15th.

Heavy seas from Gert were responsible for some minor ship damage on the 8th. At St. Kitts the launch VIKING, the barge CONQUEST, and the schooner BETSEY R. were driven ashore and wrecked, while the RIVERT TAW was damaged. The VIKING sustained heavy damage in the surf with port side completely open, while the steel hopper barge CONQUEST sustained heavy damage to bottom and sides.

Hurricane Harvey came to life on the 12th as a tropical storm near 19°N, 55°W. The following day he was a hurricane heading northwestward on a path similar to the two earlier storms. Harvey maintained a 75-kn intensity until he crossed the 25th parallel near 63°N on the 14th (fig. 25). Recurving on this parabolic path, he intensified. By early on the 15th his central pressure had dropped to 942 mb and maximum winds had increased to 115 kn. A few hours later Harvey passed about 240 mi southeast of beleaguered Bermuda. By the 16th the northeastward-moving storm was beginning to weaken. He maintained hurricane strength into the 18th, shortly before crossing the 45th meridian near 38°N. On the 20th, fast becoming extratropical, Harvey moved through the southern part of the Azores.

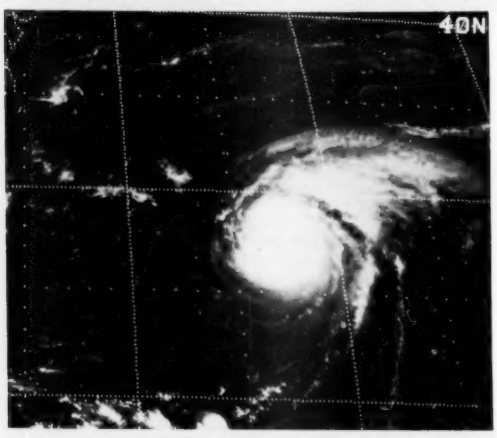


Figure 25.--Hurricane Harvey had a central pressure of 952 mb and winds of 110 kn a few hours earlier than this 1800/14 September image.

Hurricane Irene, on a course similar but eastward of the other three hurricanes, reached tropical storm strength on the 24th near 14°N, 46°W. The following day Irene was a hurricane on a north-westward heading. As she crossed the 20th parallel near 54°W, 85-kn winds blew around a 976-mb pressure center on the 26th (fig. 26). Irene reached her peak on the 28th while recurving northward as winds climbed to 95 kn around a 959-mb pressure center; by this time Irene had crossed the 25th parallel near 57°W and was beginning to turn toward the northeast. Remaining well east of Bermuda, she began to weaken as she moved over colder northern waters. However, Irene remained at hurricane strength as she gradually headed eastward toward the Azores. On the 30th she crossed the 40th parallel near 40°W, still generating 80-kn winds. By the 1st Irene passed about 150 mi north of the westernmost Azores and dropped to tropical storm strength.

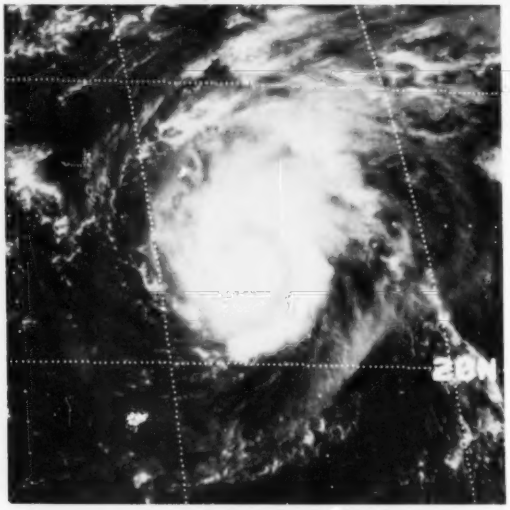


Figure 26.--Hurricane Irene at 966 mb with 92-kn winds.

Casualties--The motor vessel SANDGATE ran aground in fog in the Detroit River on the 2d. The LENA collided with the TIKAL on the North Sea in fog. Hurricane-force winds tore the banana boat AMOA from her moorings on the 2d at Galveston.

The British cargo vessel ARCTIC TIDE encountered ice and suffered damage on a voyage from Ray Point in the Northwest Territories to Resolute Bay during the period August 29 to September 11. The drilling platform WEST VENTURE broke the towing lines outside Smola, Norway, on the 6th in heavy weather. The rig was later safely anchored. The SELBYDYKE, Archangel for Bordeaux, arrived Trondheim on the 7th with weather damage.

The LESLIE GAULT struck a bridge in fog at Aalborg on the 11th. The barge D-309 capsized in heavy weather off San Fernando on a voyage to Trinidad on the 15th. The bulkcarrier NORDHVAL grounded at Novorossisk on the 17th during a gale.

The KRONPRINSESSAN VICTORIA suffered damage while entering the ferry berth at Frederikshavn during a heavy storm on the 20th. The tug OXY PRODUCER and barge OXY 4102 sank while anchored at Ponta Delgada during a heavy storm on the 20th. The Greek bulkcarrier ARMONIA suffered damage while docking at Quebec in 20-kn winds. The East German RONNEBURG encountered heavy weather in the Mediterranean the last of the month.

Other Casualties--The ALAMEIN arrived Cape Town on the 14th with weather damage from an encounter 1,000 mi west of Cape Town. The SWAN put into Maldonado Bay with a heavy list from boisterous weather. The GEMALA dragged anchor in high winds in the Maputo River.

Rough Log, North Pacific Weather

August and September 1981

ROUGH LOG, AUGUST 1981--The most significant cyclones this month were tropical. There were about the usual number of extratropical cyclones, none unusually severe. They were concentrated from Mongolia into the Sea of Okhotsk and from Ostrov Beringa eastward into the Gulf of Alaska. The last half of the month, especially the last week, there were several storms centered over the midlatitudes in the central ocean.

The primary feature on the mean-pressure pattern was the Pacific High at 1023 mb, centered near 37°N, 148°W, a few hundred miles southeast of its climatic location. The Aleutian Low at 1008 mb was shifted to Bristol Bay from its normal location near 60°N, 175°E. The usual heat LOW was over the Gulf of California. The shifting of the Aleutian Low resulted in a trough dipping into the Pacific High near longitude 155°W, and the Pacific High ridging more northwestward than usual. Low pressure replaced high pressure near the North Pole.

The shifting of the Aleutian Low with its trough resulted in a 5-mb negative anomaly near the Shumagin Islands. The northwest ridging of the Pacific High brought a plus 4-mb anomaly center near 47°N, 170°E. The LOW over the Pole produced a large minus 11-mb anomaly center that stretched southward over Greenland.

The primary low center at 700 mb was near the North Pole as usual, but it was 114 m lower than normal. Two secondary centers affected the North Pacific. One was over the central Bering Sea, and the other was over northern Manchuria. The latter rotated the primary trough westward to the Asian coast. There was a flat trough near 170°W and another sharper one off the North American west coast.

There were seven western North Pacific tropical cyclones: tropical storms Phyllis, Roy, Susan, Vanessa, and Warren, and typhoons Thad and Agnes. The eastern North Pacific produced hurricanes Fernanda and Hilary and tropical storms Greg and Irwin. A total of 11.

Extratropical Cyclones--Since the Pacific High was the primary pressure feature, a brief description of its fluctuation seems appropriate. The first 5 days there was a large HIGH of about 1037 mb near 43°N, 165°W. On the 5th the HIGH split with one center southeast of Mys. Lopatka and the other west of northern California. This allowed a large LOW to develop over the north-central ocean. By the 12th the HIGH was again consolidating and dominated the temperate ocean, except off the Asian and Alaska coasts. The last week of the month the Pacific High closely approximated climatology. There was another high-pressure center about 1,000 mi east of Tokyo.

This storm had an odd path. It formed over central Alaska on the 5th and moved south-southwestward. By 1200 on the 6th the 998-mb center was near the Shumagin Islands. At 1800 the GALLEON TOPAZ (41°N, 151°W) was near the frontal zone with 48-kn southerly winds. At 0000 on the 7th the OAKLAND was east of the low center with 40-kn southerly winds, 18-ft seas, and easterly 30-ft swells. Later in the day the ALTSER EXPRESS and SEA-LAND COMMERCE had 40- and 35-kn winds, respectively, with the former reporting 20-ft swells near 52°N, 146°W.

Figure 27.--The storm was still centered near the Shumagin Islands at 0005 on the 8th. The frontal cloud shield has moved far north and eastward from the center.

The storm made a 180-degree turn on the 7th and was headed northeastward on the 8th (fig. 27). Early on the 9th the center dissipated.

Monster of the Month--Tropical storm Vanessa was near 30°N, 160°E, on the 17th and traveling northeastward. Late in the day an extratropical LOW formed on a weak front northeast of the tropical storm. By 0000 on the 18th it was 994 mb near 40°N, 173°E. The TOYOTA MARU No. 15, at 43°N, 172°E, north of the center, had 41-kn northeasterly winds with 12-ft waves. The ERIKA BOLTEN (40°N, 180°) found 52-kn winds at 1800. On the 19th a ship in the warm sector had 18-ft waves. The LESLIE LYKES (52°N, 157°W) found 35-kn northwesterly winds with 21-ft waves on the 20th as the storm was 970 mb south of the Kenai Peninsula. By 0000 on the 21st the storm was 958 mb almost directly over buoy 46001 (fig. 28). The OVERSEAS CHICAGO near 52°N, 150°W, reported 30-ft seas and 33-ft swells with 40-kn winds. At 0600 the MOBIL MERIDIAN had 45-kn winds and 20-ft waves south of Yakutat. Buoy 46003 measured 21-ft seas at 1200. The OVERSEAS CHICAGO was sailing southward near latitude 46°N on the 22d with 20-ft swells. The storm started looping counterclockwise on the 21st and filling. On the 22d it was moving southeastward, and it disappeared on the 25th.

The Sea of Japan produced this storm on the 18th. It crossed the Tsugaru Strait and traveled along the Kuroshio Current. On the 21st it absorbed the extratropical circulation of tropical storm Vanessa. By 1200 on the 22d the storm was as far north as 59°N, 172°E, at 986 mb. On the 23d a secondary LOW formed to the southeast and became the primary center and moved southeastward. Several ships south of the center between 50°N and 55°N had gales. Late on the 23d and early on the 24th the PRESIDENT JOHNSON, near 49°N, 175°E, had 35-kn gales. Late on the 24th the DIANA had 47-kn winds in the same area, and 54 kn at 0300 on the 25th.

By the 26th the storm had deteriorated into three weak centers. One of these intensified and the BUM SIN found 43-kn winds near 40°N, 173°E. On the 27th this LOW was 988 mb near 44°N, 173°W. The BUM SIN now had 40-kn gales near 41°N, 178°E. The VERRAZANO BRIDGE on the other side of the storm (42°N, 168°W) had 39-kn gales out of the south. At 1800 the UNIVERSAL WING (48°N, 162°W) radioed winds of 47 kn. This storm weakened on the 28th and disintegrated over the Bering Sea on the 29th.

Tropical Cyclones, Western North Pacific--Tropical storm Phyllis popped up briefly west of the Bonin Islands on the 3d. Sporting winds up to 40 kn, she moved northward across the 30th parallel near 145°E. However, before reaching 35°N on the 4th, she weakened and dissipated.

As Phyllis was dying in the Pacific tropical storm Roy was coming to life over the South China Sea, some 420 mi south of Hong Kong. The depression intensified into tropical storm Roy late on the 4th. Satellite photos revealed the main cloud mass was about 150 mi in diameter. Early on the 5th the OHRMAZD encountered 41-kn winds some 90 mi southwest of the center. Roy was moving northeastward and his speed increased to

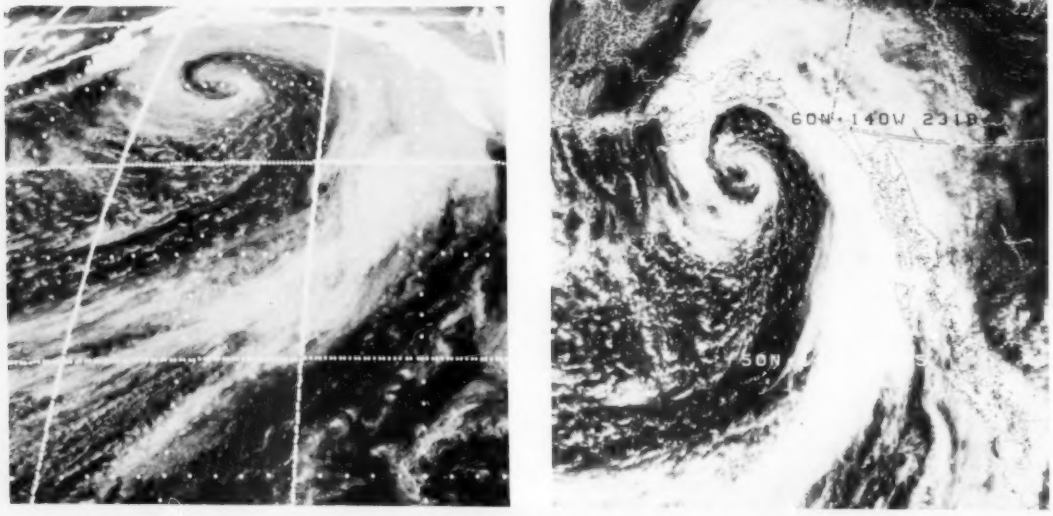


Figure 28.--Two views of the same storm on August 20. The left-hand view was taken at 2145 by the NOAA synchronous satellite and the right image was at 2318 by a NOAA polar-orbiting satellite.

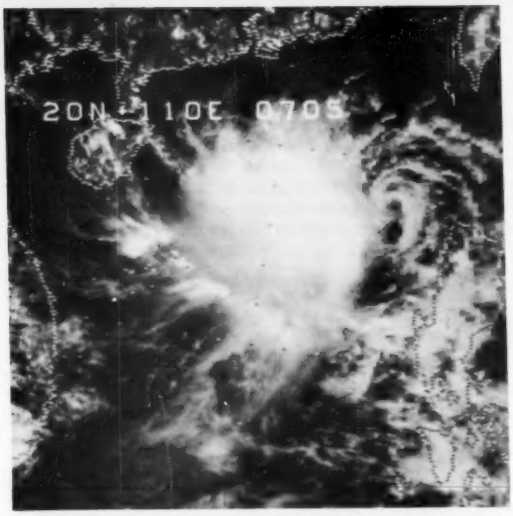


Figure 29.--At this time on the 6th there was quite a slope in the vertical alignment of Roy. The high upper clouds are some distance west of the surface center.

10 kn on the 6th as he crossed the 20th parallel near 118°E (fig. 29). The following day Roy turned westward towards Pratas Island, where pressure fell to 996.2 mb and sustained winds reached 28 kn. This indicated Roy was only a depression. He weakened even further into an area of low pressure and finally dissipated over northern Vietnam on the 11th.

While Roy was drifting toward the Vietnam coast on the 8th, tropical storm Susan was spotted about 300 mi north-northwest of Wake Island. Susan moved northward then on the 9th turned toward the northwest, as she crossed the 30th parallel near 163°E. Winds, which had been estimated at 45 kn near her center, climbed to 60 kn for a brief period early on the 10th (fig. 30). However, Susan was heading for cooler waters. She began to weaken and turn extratropical. Early on the 11th a reconnaissance aircraft reported 50-kn winds around a 978-mb central pressure. However satellite photographs indicated only weak convective activity. She fell to depression strength late on the 12th after crossing the 155th meridian near 36°N.

Figure 30.--Tropical storm Susan has the typical vertical alignment with an eye.

Typhoon Thad began to organize on the 16th in the Philippine Sea about 500 mi east of northern Luzon. As a tropical storm, Thad meandered eastward, then northward, on the 17th. The following day he was at typhoon strength heading north-northeastward toward Japan. By the 20th, after crossing the 25th parallel near 135°E, maximum winds climbed to a peak of 85 kn around a 955-mb center (fig. 31). As Thad approched Honshu on the 22d winds were estimated at 70 kn. Winds fell to 55 kn as the storm moved inland just east of Tokyo. By early on the 23d the north-northeastward-moving tropical storm was over northern Honshu and heading for Hokkaido.

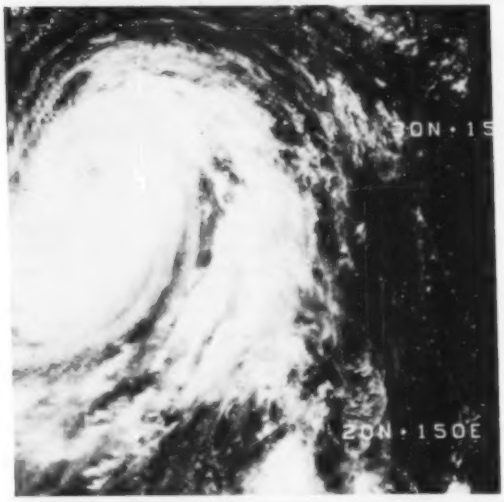


Figure 31.--Typhoon Thad was a large storm. The eye is partially obscured by high clouds.

Flooding was the major cause of damage. Over eastern and northern Honshu rivers swelled by rainfalls of up to 20 in burst their banks, leaving 24 people dead and thousands homeless. The damage in Japan was spread over 21 provinces. On the 26th the GENERAL VALDES arrived in Osaka. The freighter had developed a leak in typhoon-lashed seas on the 22d, but regained her balance after dumping overboard 1,000 m^3 of logs.

The Soviet Far East was damaged by the second tropical cyclone in less than 1 mo, when Thad passed slowly across the Khabarovsk region. Residents were still struggling to repair damages caused by Phyllis earlier in the month (Phyllis formed in July). The river Amur, which runs from the Chinese border to the Tatar Strait, had overflowed its banks. It was also reported that 15-ft seas rolled across the Sea of Okhotsk, capsizing at least one vessel.

While Thad was reaching typhoon strength on the 8th, tropical storms Vanessa and Warren were developing to the east and west. Vanessa was spotted as a tropical storm on the 17th near 28°N, 159°E, while Warren popped up just south of Hainan on the 18th. Both were short-lived. Vanessa's winds flared briefly to 45 kn on the 18th as she sped northeastward, becoming extratropical the following day as she crossed the 35th parallel near 167°E. Warren, meanwhile, brushed the southwest coast of Hainan and headed

across the Gulf of Tonkin westward toward Vietnam. Maximum winds climbed to 40 kn before he moved ashore on the 20th.

Typhoon Agnes came to life on the 26th just west of the Mariana Islands. Moving northwestward, she crossed the 20th parallel near 133°E on the 28th, as a tropical storm. The following day Agnes was at typhoon strength and approaching the southern Ryukyu Islands. Her central pressure had dropped to 977 mb. As Agnes moved through the islands and into the East China Sea, winds near her center climbed to 90 kn with gusts to 110 kn (fig. 32). Okinawa, 120 mi to the north, was reporting gusts up to 64 kn. In Naha the streets were practically deserted as winds uplifted trees and shattered billboards.

Figure 32.--Typhoon Agnes was at 25°N, 126°E, at 0556 on the 30th. Notice how the northwest winds have piled clouds against the mountains on the western side of Taiwan.

Still generating 85-kn winds on the 1st Agnes brushed the China coast near Shanghai and then recurved eastward into the Korea Strait. By the 2d Agnes had dropped back to tropical storm strength, and the following day she had turned extratropical. Agnes killed more than 70 people as she carved a path of destruction through parts of South Korea and eastern China. Along the south and east coasts of South Korea, where 13 to 26 in of rain was reported, landslides and floods were responsible for 58 deaths with 29 people missing and property damage estimated at $24 million. Nearly 30,000 people were left homeless and 167 fishing vessels were sunk or damaged. Landslides in Hokkaido, where nearly 8 in of rain had fallen, were responsible for five deaths. In the Shanghai area, nearly 300 fishing junks capsized, seawalls collapsed or were breached in 200 places, and rice and cotton fields were inundated with sea water. The Huangpu River in Shanghai reached its highest level in 30 yr.

Tropical Cyclones, Eastern North Pacific--The flurry of activity in the eastern North Pacific included hurricanes Fernanda and Hilary and tropical storms Greg and Irwin.

Hurricane Fernanda came to life on the 6th near 12°N, 104.6°W. Moving west-northwestward at 12 to 15 kn, Fernanda reached tropical storm strength early on the 7th and hurricane strength 2 days later near 14.7°N, 122°W (fig. 33). By early on the 10th maximum winds had climbed to 85 kn near her center. Late in the day winds reached a peak of 90 kn as Fernanda crossed the 130th meridian near 18°N. On the 11th the storm began to weaken and the following day it was depression strength.

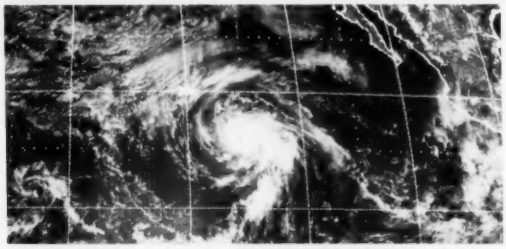


Figure 33. --Hurricane Fernanda is still a strong storm where many have started to dissipate.

Meanwhile, tropical storm Greg was coming to life near 16°N, 111.5°W, on the 13th. Moving west-northwestward, then westward, Greg attained tropical storm strength on the 14th. Maximum sustained winds reached 50 kn on the 15th. The following day Greg crossed the 120th meridian near 20°N and turned westward. Winds reached a peak of 55 kn that day. On the 17th the weakening system turned toward the west-southwest. Greg maintained tropical storm strength for the next few days and on the 20th began to reintensify near 18°N, 138°W. Moving slowly west-northwestward, Greg began to weaken as an upper air trough to the north interferred with the storm's convection. He finally dissipated near 17.3°N, 147.2°W, on the 22d.

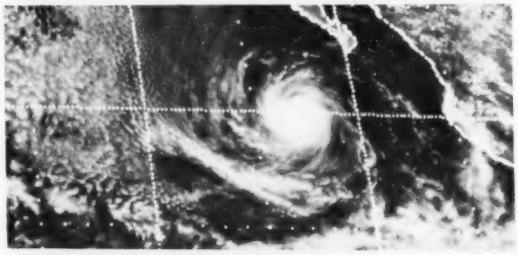


Figure 34.--Hurricane Hilary is a small storm with a distinct eye and nearly a perfect circle.

While Greg was dissipating east of Hawaii, hurricane Hilary was developing some 180 mi southwest of Manzanillo. For the first few days Hilary moved erratically, then on the 24th she headed west-northwestward (fig. 34). By this time winds had climbed to 50 kn near her center, which was approaching the 20th parallel near 113°W. On the 25th Hilary reached hurricane strength near 20.8°N, 115.7°W. Gales extended out 70 mi. Peak winds climbed to 75 kn with gusts to 90 kn later in the day. However, on the 27th

Hilary weakened rapidly as she crossed the 125th meridian heading westward.

Tropical storm Irwin came to life late on the 27th about 200 mi west-southwest of Acapulco. Unlike all the others, however, Irwin moved northward. By early on the 29th the tropical storm passed about 70 mi west of Cape Corrientes with 35-kn winds. Irwin maintained minimal intensity until early on the 30th, when he was approaching the southern tip of Baja California. A few hours later the tropical depression crossed the coast near San Jose del Cabo and moved out again near Todos Santos. The following day Irwin dissipated.

Casualties--The 157-ton fish-processing ship NORTHERN KING capsized on Bristol Bay in 30-ft seas on the 21st. Five of the seven crewmen survived. The HOKUETSU VENTURE had heavy weather damage on the 23d. The 2,996-ton ROSEBAY STAR and the NICHIAS MARU No. 11 collided in fog off Cape Inubo on the 24th. The ROSEBAY STAR sank. The ELISABETH OLDENDORFF had weather damage on arrival at Sasebo. The HYDERABAD was at Hong Kong with heavy weather damage.

Other Casualties--The 16,000-ton PRIMROSE went aground on the 2d in the Andaman Islands. Spear-carrying natives besieged the freighter, but monsoon winds and waves kept them from boarding the ship. The crew was rescued by helicopter to an Indian Navy vessel. The BLUE MASTER contacted the quay at Valparaiso on the 3d in heavy swell. The barge DM 172 sank in Bombay harbor on the 10th in bad weather. The IRENE encountered heavy weather on a voyage from Karachi to Abidjan on the 18th. The SONIA SOPHIE S. grounded near Hallaniya Island on the 14th in bad weather.

ROUGH LOG, SEPTEMBER 1981--The cyclones traced a wide path this month between the Aleutians and latitude 35°N. The traffic into the Gulf of Alaska was heavy but spread throughout the Gulf. The mean of these tracks would be east-northeastward from Honshu, curving northeastward into the Gulf of Alaska. This mean track approximated climatology.

The gross pressure pattern also approximated climatology. The Aleutian Low at 1004 mb was slightly east of Kodiak Island, rather than the normal 1006 mb in Bristol Bay. There also was a 1008-mb Low over the northern tip of Sakhalin Island. The 1022-mb Pacific High was normally located near 33°N, 140°W. There was an anomalous 1021-mb subcenter near 30°N, 178°E, and a 1018-mb subcenter near 40°N, 163°E.

There were three anomaly centers along latitude 55°N. A minus 6 mb over the Gulf of Alaska, a plus 7 mb over the Bering Sea, and a minus 3 mb over the western Sea of Okhotsk. There was generally higher-than-normal pressure across the subtropical ocean.

The upper air winds at 700 mb were mainly zonal between latitudes 35° and 50°N. There was a long-wave trough that paralleled the Asian coast slightly off the coast. Another long-wave trough paralleled longitude 150°W southward from Kodiak Island. These both were shifted eastward from climatology.

There were four typhoons over the western ocean: Bill, Clara, Doyle, and Elsie. Hurricane Jova and tropical storm Knut visited the eastern ocean.

Extratropical Cyclones--At times the ocean was cut up by many small extratropical cyclone centers with a tropical cyclone included for good measure. In general, this kept the severity of the extratropical cyclones low.

During the first week the Pacific High had a double center with the one over midocean dominating in the last of the week. This deflected the cyclones farther to the west and north. During the second week the High built back to double centers with the eastern center breaking down in the last part of the week. During the third week the Pacific High was multicentered with frontal waves forming between and south of the centers. The fourth week a HIGH off Japan moved northeastward to near the Aleutian Islands. It built southeastward, and by monthend was normally located off the North American coast.

This storm was the extratropical remains of typhoon Agnes. It became extratropical on the 3d over the Sea of Japan. On the 4th the ORIENTAL DIPLOMAT had 50-kn winds east of Tokyo. Later in the day, Japanese and Soviet fishing vessels reported winds from 35 to 50 kn along the Kuril Islands. On the 5th the storm was 976 mb near 50°N, 155°E. There were many wind reports near 50 kn, but the FORTUNSTAR (46°N, 162°E) reported winds near 60 kn twice. The waves were not as high as might be expected, but the PRESIDENT TYLER located 33-ft swells near 47°N, 157°E. At 0000 on the 6th she reported 40-ft swells. The wind was still blowing up to 50 kn at times.

On the 6th and 7th the storm was caught in the zonal flow and raced along the Aleutians. The maximum winds were gales with isolated swell reports of near 20 ft. The storm was moving northeastward into the Gulf of Alaska on the 8th. There were a few gales and high waves, which should not have bothered the merchant fleet. There was a 25-ft swell report near 50°N, 150°W, on the 9th. The storm weakened rapidly as it moved over Alaska.

This storm was also the extratropical conversion of a tropical cyclone--Bill. By 1200 on the 7th, Bill had incorporated a frontal system into his circulation and had lost the tropical characteristics. The storm was 992 mb near 45°N, 170°E, at 0000 on the 8th. A Japanese ship had gales and 23-ft waves and 996-mb pressure less than 100 mi south of the center. The EAGLE ARROW (47°N, 165°W) reported 52-kn winds from the southeast at 0600 on the 9th. The 986-mb storm was near 51°N, 155°W, at 0000 of the 10th. The STAR MAGNATE (51°N, 141°W) reported 42-kn winds with 25-ft swells. The winds were generally gales on the 10th and 11th with a few reports of swell waves up to 20 and 25 ft. The storm moved over the coast near Yakutat on the 11th.

A frontal wave south of Tokyo was the beginning of this storm on the 8th. It traveled northeastward until the 10th, then eastward along approximately 47°N latitude. The winds were generally below gale force until the 14th. At 1200 the 982-mb storm was near 49°N, 148°W. At 1800 the BROOKS RANGE had 55-kn easterly winds near 58°N, 144°W, with 30-ft seas and 38-ft swells. The GOLDEN GATE (59°N, 145°W) had 48-kn winds, 30-ft seas, and 33-ft swells on the 15th. The storm went ashore on the 16th.

This was one of the frontal waves that developed between two HIGH centers. By 0000 on the 16th there were some near gales and the PACMONARCH, northwest of the center, had 26-ft swells out of the north. Some gales developed on the 17th. At 1800 the ATLANTIC PIONEER (47°N, 141°W) reported 48-kn winds with 41-ft swells. The swells increased to 46 ft by 0600 on the 18th. The RED ARROW had 50-kn winds and 33-ft waves. The LOW was 970 mb at 0000 on the 18th near 50°N, 140°W. Several other ships had waves near 30 ft that day. This storm went ashore across the Kenai Peninsula on the 19th, 3 days behind the previous storm.

Two low-pressure centers combined into one off the Kamchatka Peninsula on the 21st. The first 18 hr the LOW moved toward the southwest, an odd direction. Or the 22d the storm turned eastward and traveled along latitude 50°N. The storm was of little consequence until it approached the North American coast on the 26th. At 1200 it was 990 mb near 48°N, 138°W. Buoy 46004 measured 20-ft seas. On the 27th (fig. 35) the PHILADELPHIA (55°N, 141°W) found 45-kn winds but very light 7-ft seas for the windspeed. Others were finding gales but also light seas. The buoy 46006 measured 20-ft seas 600 mi southwest of the center. On the first chart of the 28th a German ship (45°N, 138°W), near the same relative position to the center as was the buoy, found 33-ft waves. The storm was on the coast of British Columbia.

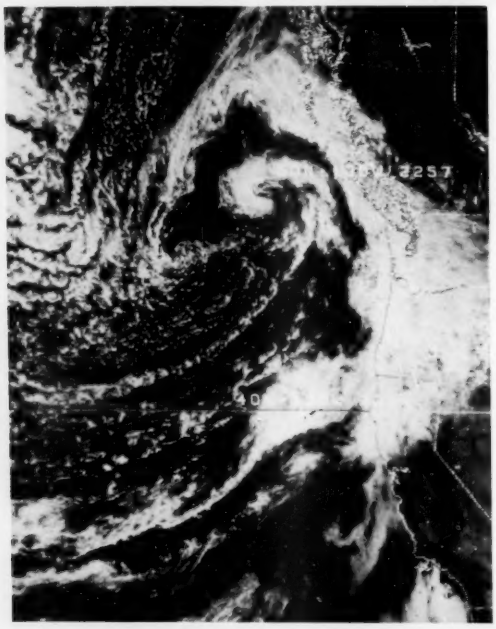
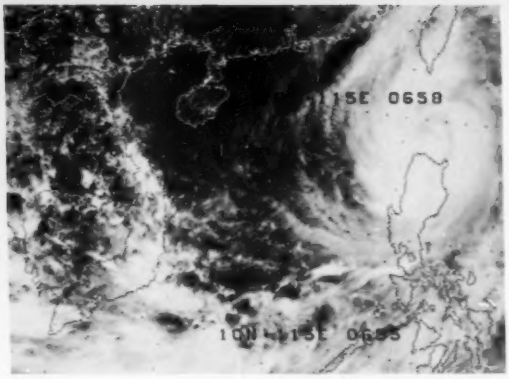


Figure 35.--The storm was west of Cape Scott late on the 26th. The front has moved against the coast. The line of northeast-southwest-oriented clouds out of the center is a trough line. What looks like a bird in British Columbia is Williston Lake.

This storm formed in the wake of typhoon Doyle on the 23d just before he turned extratropical. The frontal wave first moved southeastward, then took a jagged northerly course. At 0000 on the 27th the 996-mb storm was near 42°N, 173°E. The SEA-LAND DEVELOPER (47°N, 175°W) had 45-kn east-southeasterly winds, and the QUINTINA (48°N, 175°E) had 38-kn east-northeasterly winds. By 0000 on the 28th the storm had split into two centers. The DIAMOND PHOENIX, west of the northern center, had 43-kn winds and 20-ft waves. Several other ships in the western quadrant had 15- to 20-ft waves. The analysis of 0000 on the 29th indicated the new southern LOW had captured the circulation, and a frontal wave was moving around its southern periphery. There were several 40-kn gale reports. On the 30th there was another switch of centers to the frontal wave. The SINCERE No. 5 (42°N, 179°E) was northwest of the center with 40-kn winds, 31-ft seas, and 34-ft swells. On October 1 the storm weakened and was no longer of consequence.

Tropical Cyclones, Western North Pacific--Typhoon Bill popped up on the 3d about 100 mi south of Marcus Island. Bill reached typhoon strength the following day as he began to turn toward the north on a parabolic track. By the 6th he had crossed the 30th parallel near 145°E, and maximum winds rose to a peak of 85 kn. Bill continued his swing toward the northeast and began to turn extratropical. On the 7th, as he crossed the 40th parallel near 158°E, he completed this transformation.

Typhoon Clara originated as a tropical depression about 280 mi west-southwest of Guam on the 15th. Two days later she became a tropical storm. Clara further intensified to a typhoon some 420 mi east of Manila on the 18th while moving northwestward at about 11 kn. Her overcast area was about 150 mi in diameter. In early evening a reconnaissance aircraft reported 115-kn winds around a 924-mb central pressure. About noon on the 20th Clara passed about 20 mi southwest of Calayan, just north of Luzon, where sustained winds of 52 kn and a pressure of 977.1 mb were recorded. A Philippine Navy destroyer ran aground off Calayan, and there were only 18 survivors from a crew of 97 (fig. 36). Flooding was severe in the Philippines and thousands were left homeless in northern Luzon. Heading west-northwestward, Clara entered the South China Sea late on the 20th. Early the next morning the MARTHA BAKKE reported sustained winds of 50 kn. On Taiwan up to 22 in of rain was recorded in some places. During the morning Clara passed about 50 mi northeast of Pratas Island, where winds of 45 kn and a pressure of 984.7 mb were recorded. During the afternoon Clara turned northwestward at about 10 kn. Shortly before Clara moved ashore between Hong Kong and Shantou, Shanwai reported northerly 30-kn winds with a gust of 62 kn. Gusts also reached 60 kn at Shantou, while in the Hong Kong area gusts ranged up to 51 kn at Cheung Chau. According to press reports, power supplies and communications were disrupted in districts around Shantou, where 21,000 hectares of farmland were flooded. Clara was responsible for 62 deaths and left several thousand homeless in south China.



Navy Chief, Rear Admiral Simeon Alejandro.

Typhoon Doyle flared briefly northeast of Marcus Island before turning extratropical. The tropical storm was pinpointed at 26.5°N, 164.1°E, at 0600 on the 20th; this is unusually far north for tropical storm development. However, Doyle wasted no time reaching typhoon strength, which he accomplished on the 21st as he began to recurve northeastward. Maximum winds climbed to 80 kn as Doyle crossed the 30th parallel on the 22d near 164°E. The following day winds dropped below typhoon strength as Doyle accelerated northeastward. Doyle was fast becoming extratropical.

Typhoon Elsie sprung to life on the 24th about 120 mi south of Guam. Heading west-northwestward she quickly attained typhoon strength by early on the 26th. This explosive deepening continued as Elsie began her parabolic recurvature by turning toward the north. During the 27th maximum winds increased from 115

Figure 36.--The satellite image shows Clara on the 28th when the Philippine Navy destroyer escort DATU KALANTIAW was driven aground on Calayan island north of Luzon. NOAA and Wide World Photos.

The ship that ran aground on a reef off Calayan Island was the 1,220-ton DATU KALANTIAW, a Philippine Navy destroyer and ex-USS BOOTH. This was the Philippine Navy's worst disaster since World War II. Rescuers called in Navy welders with blow torches to cut through the hull after noises were heard on the inside. The U.S. ammunition ship MOUNT HOOD left the scene carrying 40 bodies after 2 days of rescue assistance. The chief engineer, one of the 18 survivors, said high waves snapped the vessel's moorings and smashed the ship on the rocks. The large number of casualties was attributed to giant waves that washed crewmen off the deck, as they prepared to jump ship, and smashed them on the rocks. "Only those who elected to remain aboard survived," said Philippine

kn to an estimated 140 kn. By the 29th after crossing the 135th meridian near 17°N, maximum sustained winds near Elsie's center rose to 150 kn with gusts estimated at 180 kn. A few hours after this peak, her sea-level central pressure was estimated at 898 mb. Elsie was at supertyphoon strength (120 kn or more) from about 0600 on the 27th through 1200 on the 29th. By this time Elsie was about 540 mi west-southwest of Iwo Jima. A short time later Elsie began to turn toward the east-northeast. By the 1st her maximum winds had dropped below 90 kn as she crossed the 30th parallel near 137°E. Over colder water Elsie began to turn extratropical. On the 2d winds dropped to tropical storm strength and the storm accelerated (figs. 37 and 38).

Figure 37.--Typhoon Elsie had 150-kn winds about the time of this image.

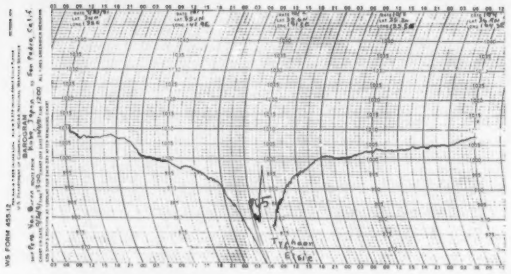


Figure 38.--The PRESIDENT VAN BUREN registered a low pressure of 959 mb in an encounter with typhoon Elsie at 0700 on October 2.

Tropical Cyclones, Eastern North Pacific--Hurricane Jova was first reported as a depression west of 120°W (14.7°N, 122.8°W) on the 14th. She reached tropical storm strength later that same day and hurricane strength the following day. Jova was heading west-northwestward at about 10 kn. Around 1200 on the 17th she crossed the 135th meridian near 18°N. At that time winds near her center were at a peak of 70 kn with gales extending out 100 mi in all directions. Early on the 18th near the 20th parallel, Jova turned westward at about 12 to 15 kn. She also began to weaken. Jova dropped back to tropical storm strength as she crossed the 140th meridian near 20°N. She remained on a westward course for Hawaii over the next several days, but continued to weaken. By early on the 20th, Jova was about 200 mi east of Honolulu and turning toward the west-northwest. Winds near her center were estimated at 35 kn. The Hawaiian Islands were buffeted by gusty winds and locally heavy showers as Jova skirted to the north. During the evening of the 20th she had weakened to a depression about 100 mi northeast of Kauai (fig. 39).

Meanwhile, tropical storm Knut had come to life some 300 mi south of Manzanillo on the 19th. Knut headed northwestward and by early on the 20th was generating 50-kn winds about 300 mi southwest of Manzanillo. The storm then turned toward the north-northwest, brushing Socorro Island and then, after crossing the 20th parallel near 110°W, he turned northeastward. Sporting 40-kn winds on the 21st, Knut moved ashore near Mazatlan, Mexico (fig. 40).

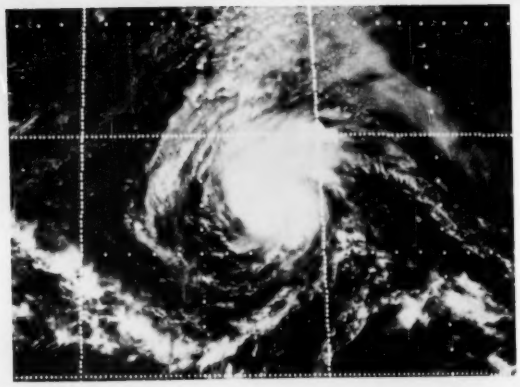


Figure 39.--Hurricane Jova is part of a wave in the Intertropical Convergence Zone.

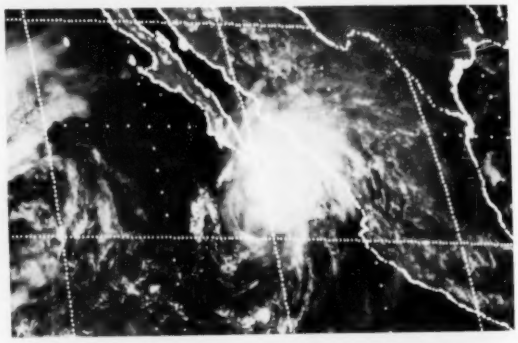


Figure 40.--Tropical storm Knut going ashore in the Gulf of California.

Casualties--The 10,262-ton OCEAN ENDURANCE was surveyed at Kobe for heavy weather damage the first of the month. The JONG KONG had leakage of seawater in heavy weather on the 3d near 26°N, 128°E. The YAYASAN TIGA requested a survey at Sasebo for weather damage on the 12th. The HOKUETSU VENTURE suffered weather damage. The CANMAR EXPLORER II had weather damage on the 28th while drilling in the Beaufort Sea. The NURLINA VI sank in the Strait of Macassau during a strong storm on the 29th. There were 64 passengers, 24 crew, 37 cows on deck, and 280 packages of general cargo in the hold. It was believed 33 people were lost. It is presumed the cows also were lost.

The following three vessels had weather damage at unspecified times: AOTEA, CAPTAIN HOOK, and the HOKUETSU MARU.

Other Casualties--The MANDAMA reported at Fremantle on the 9th with weather damage. The BELLE ISLE suffered weather damage in the Indian Ocean on the 5th. The SHEREEN reported at New Plymouth on the 11th with weather damage. The 300-ton sailing vessel TTN No. 48 sank in a storm off Sri Lanka. The VIRA drifted in strong winds and grounded on the 25th at Khulna, Bangladesh.

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ADDRESSES OF NATIONAL WEATHER SERVICE PORT METEOROLOGICAL OFFICES

NOAA National Weather Service Port Meteorological Offices have personnel who visit ships in port to check and calibrate barometers and other meteorological instruments. In addition, port meteorologists assist masters and mates with problems regarding weather observations, preparation of weather maps, and forecasts. Meteorological manuals, forms, and some instruments are also provided.

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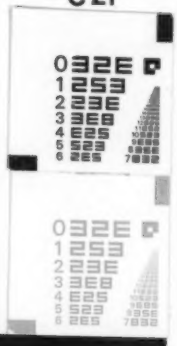
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